MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. XXXV. *January* 8, 1875. No. 3.

Professor J. C. ADAMS, President, in the Chair.

Charles Henry Martin, Esq., Combe Lodge, Charlton Road, Blackheath;

George Smyth Baden-Powell, Esq., Balliol College, Oxford;

William Ricketts Cooper, Esq., Sec. Soc. Bib. Archæology, 5 Richmond Grove, Barnsbury, N.;

George Staley Mosse, Esq., 12 Eldon Road, Kensington;

Albert Duncan Austin, Esq., Civil Engineer, Nelson, New Zealand;

were balloted for and duly elected Fellows of the Society.

The following letter, addressed by command of H.M. the King of Siam to the Siamese Consul in London, has been communicated by him to the Society:—

The Royal Palace, Bangkok,
October 9, 1874.

My dear Sir,—I have much pleasure in informing you that I have received the commands of His Majesty to request you to inform the Royal Astronomical Society, that if it will appoint men of science to observe the Total Eclipse of April next, His Majesty will be happy to consider them as his private guests during their visit, and will take on himself their entertainment,

and provide them with transport for themselves and their instruments from Bangkok to the station selected by them and back again; and will erect such temporary buildings as are required for them and their instruments.

A communication to this effect will be made by his Excellency the Minister for Foreign Affairs to the acting British Consul General here; but, as this will be slow in reaching the gentlemen interested, His Majesty has commanded me to address this note to you, relying on you to communicate it to the Society as soon as possible.

I shall be most happy to receive any communication from the Secretary of the Society named; and if any gentlemen propose to avail themselves of His Majesty's invitation, I should wish to receive particulars of the probable number of the party or parties, of the station or stations proposed, and the foundations required for instruments,—a plan in fact, of each intended observatory, that I may submit them for his Majesty's orders.

You may state that our topographer, Captain Loftus, and other officers who as surveyors are accustomed to precise observations, will be happy to assist if desired, and His Majesty will willingly release them from their other duties for this purpose.

With the assurance of my high esteem,

Believe me,

My dear Sir,

Your most faithful friend,

(Signed) Bhashakarawongse,

H.S.M. Private Secretary.

D. K. Mason, Esq.

Phra Siam Dhurabah,

His Siamese Majesty's Consul in London.

Further Ring-Micrometer Observations of Coggia's Comet (III. 1874).

By John Tebbutt, Esq.

The following observations of Coggia's Comet have been reduced since my communication of the 27th August. The effect of refraction on the differential observations being scarcely appreciable, the corrections on that account have been disregarded. The comparisons to the 24th August inclusive have been corrected for the Comet's proper motion, but no corrections have been applied for parallax.

1874.	Windsor M.T. h m s	Comets. App. R.A.	m s	App. N.P.D.	′ ″	No. of Comps.
Aug. 6	6 15 40	Lacaille 3086	+7 37·83	Lacaille 3086	− 0 23·8	1
„ 6	6 15 40	*a*	+3 56·85	*a*	− 0 6·1	1
„ 7	6 19 17	.....		Lacaille 3180	+ 1 18·6	3
„ 7	6 23 49	Lacaille 3180	−4 19·91	.....		4
„ 13	6 34 54	Lacaille 3193	−0 39·23	Lacaille 3193	+ 0 9·0	5
„ 14	6 43 41	.....		*b*	+ 1 15·2	3
„ 14	6 51 37	*b*	+1 23·88	.....		4
„ 18	16 14 29	*c*	+3 52·84	*c*	−10 50·2	5
„ 18	16 26 41	*d*	+0 2·13	*d*	+ 1 5·1	5
„ 20	6 59 33	*e*	+9 1·34	*e*	+ 0 32·0	
„ 22	7 7 10	*f*	−1 3·75	*f*	− 0 17·5	
„ 24	7 8 6	*g*	−5 49·84	*g*	+ 2 1·2	3
„ 25	7 19 30	.....		*h*	− 0 54·4	6
„ 25	7 24 10	*h*	−1 59·11	.....		7
„ 26	6 54 7	*i*	+6 56·58	*i*	− 3 9·4	2
„ 26	16 1 16	*j*	+1 14·18	*j*	−11 57·7	3
„ 26	16 38 15	B.A.C. 2770	+6 16·60	.....		8
„ 26	16 57 42	.....		B.A.C. 2770	− 2 49·1	5
„ 26	17 0 26	*i*	+7 7·95	.....		5
„ 26	17 8 39	.....		*i*	+10 0·9	4

The following are the positions of the comparison-stars not identified, with reference to other stars which could be identified at the time:—

Comp.-Star.	Mag.	R.A.	m s	N.P.D.	′ ″
a	7	Lacaille 3086	+ 3 41·0	Lacaille 3086	− 0 18
b	7½	B.A.C. 2665	+11 9·5	B.A.C. 2665	−12 23
c	7	B.A.C. 2626	+18 47·0	B.A.C. 2626	+ 9 12
d	8	*c*	+ 3 51·1	*c*	−11 33
e	8	B.A.C. 2656	+ 8 38·4	B.A.C. 2656	+11 32
f	8½	Lacaille 3286	− 2 46·4	Lacaille 3286	+ 8 6
g	8	$8^h\ 17^m\ 57^s$		149° 32′	
h	8	B.A.C. 2669	+20 22·7	B.A.C. 2669	− 1 39
i	7	B.A.C. 2770	− 0 51·2	B.A.C. 2770	−12 43
j	7¼	B.A.C. 2770	+ 5 2·2	B.A.C. 2770	+ 8 19

i and *j* are probably Lacaille 3211 and 3264 respectively.

the catalogued right ascensions and north polar distances being too large.

The remaining observations of the Comet, extending to the 7th instant, shall be forwarded, if possible, by next mail.

Windsor, N.S. Wales,
October 22, 1874.

Ephemeris for Physical Observations of Jupiter.

By A. Marth.

(*Communicated by Warren De La Rue, Esq.*)

Greenwich, Noon.	Angle of position of ♃'s axis.	Western long. of ♃'s meridian turned to the Earth.		Difference of long. of Sun and Earth.		Latitude of Earth above ♃'s Equator.	Latitude of Sun above ♃'s Equator.
1875.	°	°	°	°	°	°	°
Feb. 20	21·40	125·04		−9·06		−3·19	−2·83
			4356·46		+0·50		
25	21·43	158·50		8·56		3·21	2·84
			3·52		·57		
Mar. 2	21·47	192·02		7·99		3·22	2·85
			3·57		·65		
7	21·53	225·59		7·34		3·23	2·86
			3·62		·72		
12	21·61	259·21		6·62		3·24	2·86
			3·66		·79		
17	21·70	292·87		5·83		3·24	2·87
			3·68		·84		
22	21·80	326·55		4·99		3·24	2·88
			3·70		·90		
27	21·92	0·25		4·09		3·24	2·89
			3·71		·95		
Apr. 1	22·04	33·96		3·14		3·24	2·89
			3·71		·98		
6	22·17	67·67		2·16		3·23	2·90
			3·69		1·00		
11	22·30	101·36		1·16		3·21	2·91
			3·67		1·01		
16	22·43	135·03		− 0·15		3·20	2·91
			3·64		1·02		
21	22·56	168·67		+ 0·87		3·18	2·92
			3·59		1·01		
26	22·68	202·26		1·88		3·16	2·92
			3·53		0·99		
May 1	22·80	235·79		2·87		3·13	2·93
			3·46		·96		
6	22·91	269·25		3·83		3·11	2·94
			3·39		·92		
11	23·01	302·64		4·75		3·03	2·94
			3·31		·87		
16	23·10	335·95		5·62		3·05	2·95
			3·22		·82		

Greenwich, Noon. 1875.	Angle of position of ♃'s axis.	Western long. of ♃'s meridian turned to the Earth.		Difference of long. of Sun and Earth.		Latitude of Earth | Sun above ♃'s Equator.	
	°	°		°		°	°
May 21	23·17	9·17		6·44		3·02	2·95
			3·13		·76		
26	23·24	42·30		7·20		3·00	2·96
			3·04		·68		
31	23·30	75·34		7·88		2·97	2·96
			2·94		·62		
June 5	23·34	108·28		8·50		2·94	2·97
			2·85		·54		
10	23·37	141·13		9·04		2·91	2·97
			2·76		·47		
15	23·38	173·89		9·51		2·89	2·98
			2·66		·40		
20	23·39	206·55		9·91		2·87	2·98
			2·58		·32		
25	23·38	239·13		10·23		2·85	2·96
			4352·50		+0·24		
30	23·35	271·63		+10·47		−2·83	2·99

The longitudes of the meridians on *Jupiter's* surface are here reckoned from an arbitrary First Meridian (that which, at midnight preceding January 1, 1872, was apparently directed to the Earth), which is (arbitrarily) assumed to rotate at the daily rate of 870°·60. The adopted constant of the equation of light is $497^{s}\cdot78$. The "difference of longitude of Sun and Earth," or the "annual parallax" on which the computation of phase depends, is, of course, reckoned in the plane of *Jupiter's* equator. The position of this plane has been assumed in accordance with Damoiseau's determination of it for 1750, from the observed eclipses of the third satellite. This position is for 1875·0.

					°
Inclination of *Jupiter's* equator to cel. equator of 1875·0	=	25·4351
Node	„	„	on	„	„	357·9682
Inclination	„	„	to ecliptic		„	2·1504
Node	„	„	on	„	„	336·0583
Arc	„	„	between ecliptic and equator			337·9088

Ephemerides of 12 close Circumpolar Stars suitable for the determination of Azimuth Error. By the Rev. C. Pritchard, F.R.S., Savilian Professor of Astronomy.

As the time is approaching when we may hope to commence active work at the new *University Observatory* in Oxford, I felt it desirable to complete such preparations as might facilitate our operations. We do not intend to undertake any meridional

observations beyond those necessary for the exact determination of our Time: hence we should sometimes find it inconvenient to wait in the transit room, and away from our proper work, until stars suitable for the Azimuth Correction for the instrument might come to the meridian. On this ground chiefly I requested Mr. W. E. Plummer, whom, on account of his great experience and excellent reputation as an astronomer, I have been glad to appoint as Principal Assistant, to select twelve close circumpolar stars in such positions that they might come to our meridian in pairs above and below pole, and at hours when we could not conveniently avail ourselves of the four circumpolars inserted in the *Nautical Almanac*.

For the sake of shortening the tables as much as possible, our Ephemerides have been calculated for every five days, so as to bring them within the reach of the simplest interpolation for intervening days. In so doing it was useless, with such intervals of time, to apply the terms involving 2 ☽ in the nutation; but, in order to give the results all necessary exactness, a very short table has been appended, whereby, after the interpolation has been made for any of the four intervening days, the small correction may be applied for the term involving 2 ☽ already referred to. The simple process required for this exact determination need not require the expenditure of two minutes; and it was considered by us preferable to adopt this course rather than extend our Ephemerides to five times their present length.

Having thus prepared our Ephemeris for 1875, with a view to our own convenience, it occurred to me that the publication of these tables might prove a convenience and a boon to other observatories also; and if that convenience should eventually be found to be substantial and considerable, then it might be probable that the Director of the *Nautical Almanac* would take the matter into his consideration for future years.

The Catalogues that have been used in the formation of the mean place for 1875·0 are those published from the Radcliffe and Redhill Observatories (for these contain a greater number of observations of stars of considerable declination than are to be found in any other volumes of observations), and to make the place as reliable as possible, no star has been selected that has not at least 30 observations of Right Ascension. The precessions were computed from the rigorous formulæ employing the constants of Professor Peters for lunisolar and planetary precession, and the final results examined to detect, if possible, any proper motion. To the two stars Radcliffe 2594 and Groombridge 1850 an annual proper motion in Right Ascension of $+0^s\cdot020$ and $-0^s\cdot041$ respectively, referred to the Equator of 1875, has been applied. With this proper motion (determined from about 30 years' observation only) the probable error of the mean place is reduced from $0^s\cdot239$ to $0^s\cdot138$ in the first case, and from $0^s\cdot223$ to $0^s\cdot025$ in the latter. The precessions in Declination have been applied as rigorously as in Right Ascension; but the results have

not been examined for the detection of proper motion, since the same amount of accuracy was not required.

The accompanying table sufficiently describes itself.

Star's Name.	Mag.	No. of Obs. of R.A.	Mean R.A. 1875·0.			Prob. Error of Mean R.A. × cos δ.	No. of Obs. of δ.	Mean δ 1875·0.		
			h	m	s	s		°	′	″
Radcliffe 713	7·9	32	2	25	22·211	0·009	13	86	30	2·1
Groombridge 642	6·0	73	3	25	41·559	0·025	22	86	14	54·6
Radcliffe 1474	7·9	33	5	32	27·583	0·016	27	87	18	50·3
Radcliffe 2368	7·8	36	9	36	23·848	0·006	25	87	10	16·2
Radcliffe 2594	7·6	58	10	58	19·796	0·004	28	88	19	5·3
Groombridge 1850	6·5	78	11	58	26·193	0·001	41	86	16	45·9
Groombridge 2099	7·3	38	14	2	30·447	0·022	25	86	21	21·9
Groombridge 2283	7·0	74	15	18	18·106	0·016	27	87	42	36·3
Radcliffe 3750	8·5	36	16	47	34·353	0·002	19	89	16	46·2
Groombridge 3548	7·6	101	21	24	11·668	0·009	45	86	30	57·2
Radcliffe 5776	7·4	52	22	28	1·426	0·009	37	87	26	46·2
Groombridge 4101	5·7	70	23	27	48·174	0·024	56	86	37	3·5

The interval chosen for the computation of apparent places is sufficiently short to make interpolation easy, but not short enough to admit of the incorporation of the terms that involve functions of $2\,\mathfrak{D}$. To facilitate the computation of this correction, the following table is given, with the necessary factors for each star. The numbers in brackets are logarithms.

Radcliffe 713	−(8·8116) sin $2\,\mathfrak{D}$	−(8·8903) cos $2\,\mathfrak{D}$
Groombridge 642	−(8·8866) ,,	−(8·7492) ,,
Radcliffe 1474	−(9·1039) ,,	−(8·1781) ,,
Radcliffe 2368	−(8·8848) ,,	+(8·9855) ,,
Radcliffe 2594	−(8·7887) ,,	+(9·2871) ,,
Groombridge 1850	−(8·1140) ,,	+(8·9577) ,,
Groombridge 2099	+(8·4895) ,,	+(8·9016) ,,
Groombridge 2283	+(8·9573) ,,	+(8·9808) ,,
Radcliffe 3750	+(9·5986) ,,	+(9·1637) ,,
Groombridge 3548	+(8·6382) ,,	−(8·8771) ,,
Radcliffe 5776	+(8·5437) ,,	−(9·0855) ,,
Groombridge 4101	+(6·5898) ,,	−(8·9949) ,,

The Ephemeris is, then, as follows:—

Apparent Places for Greenwich Mean Midnight.

Date. 1875.	Radcliffe 713. R.A.	Radcliffe 713. δ	Groombridge 642. R.A.	Groombridge 642. δ	Radcliffe 1474. R.A.	Radcliffe 1474. δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
Jan. 1	2 25 23·14	86 30 23·1	3 25 47·98	86 15 14·6	5 32 50·31	87 19 3·9
6	21·68	24·0	46·93	15·9	50·00	5·6
11	20·15	24·8	45·76	16·9	49·46	7·1
16	18·55	25·4	44·49	17·9	48·71	8·6
21	16·89	25·9	43·13	18·8	47·75	10·1
26	15·19	26·2	41·70	19·5	46·59	11·4
31	13·48	26·3	40·21	20·0	45·25	12·7
Feb. 5	11·77	26·3	38·67	20·4	43·72	13·9
10	10·07	26·1	37·09	20·6	42·03	14·9
15	8·40	25·8	35·50	20·6	40·20	15·8
20	6·79	25·2	33·91	20·6	38·27	16·6
25	5·24	24·5	32·35	20·4	36·23	17·2
Mar. 2	3·77	23·8	30·82	19·9	34·11	17·6
7	2·40	22·8	29·35	19·4	31·95	18·0
12	1·14	21·8	27·96	18·7	29·78	18·2
17	25 0·01	20·7	26·65	17·8	27·60	18·1
22	24 59·01	19·5	25·42	16·9	25·43	17·9
27	58·15	18·2	24·29	15·9	23·30	17·6
Apr. 1	57·46	16·8	23·28	14·7	21·25	17·2
6	56·92	15·3	22·41	13·5	19·28	16·5
11	56·54	13·9	21·70	12·1	17·41	15·8
16	56·34	12·4	21·13	10·7	15·67	14·9
21	56·30	10·9	20·70	9·4	14·07	13·9
26	56·43	9·4	20·42	8·0	12·62	12·8
May 1	56·72	8·0	20·30	6·4	11·34	11·7
6	57·18	6·5	20·33	4·9	10·24	10·4
11	57·81	5·1	20·52	3·5	9·33	9·1
16	58·59	3·8	20·87	2·0	8·62	7·7
21	24 59·51	2·6	21·36	15 0·6	8·12	6·2
26	2 25 0·57	86 30 1·4	3 25 22·00	86 14 59·2	5 32 7·82	87 19 4·8

[*Cont.* p. 118.]

Apparent Places for Greenwich Mean Midnight.

Date. 1875.	Radcliffe 2368. R.A.	δ	Radcliffe 2594. R.A.	δ	Groombridge 1850. R.A.	δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
Jan. 1	9 36 50·22	87 10 8·6	10 58 55·55	88 18 51·2	11 58 37·86	86 16 28·2
6	52·08	9·6	59·26	51·7	39·64	28·2
11	53·78	10·7	59 2·81	52·3	41·39	28·4
16	55·30	11·9	6·16	53·1	43·09	28·7
21	56·63	13·2	9·29	54·1	44·72	29·2
26	57·76	14·6	12·17	55·1	46·28	29·9
31	58·69	16·0	14·78	56·2	47·76	30·7
Feb. 5	59·39	17·5	17·10	57·5	49·15	31·6
10	36 59·88	19·1	19·10	18 58·8	50·42	32·7
15	37 0·15	20·6	20·76	19 0·2	51·56	33·8
20	0·21	22·2	22·07	1·7	52·55	35·1
25	37 0·04	23·8	23·03	3·2	53·39	36·5
Mar. 2	36 59·64	25·3	23·62	4·8	54·09	37·9
7	59·03	26·8	23·84	6·4	54·63	39·4
12	58·22	28·2	23·71	8·0	55·01	40·9
17	57·23	29·6	23·21	9·5	55·22	42·4
22	56·07	30·9	22·37	10·9	55·28	44·0
27	54·74	32·1	21·19	12·3	55·17	45·5
Apr. 1	53·27	33·1	19·70	13·8	54·90	47·0
6	51·66	34·1	17·90	15·1	54·47	48·5
11	49·95	34·9	15·82	16·3	53·91	49·9
16	48·15	35·6	13·49	17·4	53·21	51·3
21	46·27	36·1	10·93	18·3	52·38	52·6
26	44·33	36·5	8·16	19·2	51·42	53·7
May 1	42·36	36·8	5·22	20·0	50·36	54·8
6	40·36	36·9	2·12	20·7	49·19	55·8
11	38·37	36·8	58 58·89	21·2	47·94	56·7
16	36·40	36·7	55·58	21·5	46·61	57·4
21	34·46	36·4	52·20	21·6	45·21	58·0
26	9 36 32·58	87 10 35·9	10 58 48·79	88 19 21·6	11 58 43·76	86 16 58·4

[*Cont.* p. 119.]

Date. 1875.	Radcliffe 713. R.A.	δ	Groombridge 642. R.A.	δ	Radcliffe 1474. R.A.	δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
May 31	2 25 1·77	86 30 0·3	3 25 22·79	86 14 57·9	5 32 7·73	87 19 3·3
June 5	3·08	29 59·3	23·71	56·7	7·84	1·8
10	4·51	58·4	24·76	55·5	8·17	19 0·3
15	6·05	57·7	25·94	54·4	8·71	18 58·8
20	7·67	57·0	27·22	53·5	9·45	57·4
25	9·37	56·5	28·60	52·6	10·38	55·9
30	11·13	56·1	30·08	51·8	11·50	54·5
July 5	12·96	55·8	31·64	51·1	12·82	53·1
10	14·83	55·7	33·29	50·6	14·32	51·8
15	16·73	55·7	35·01	50·2	15·98	50·6
20	18·65	55·8	36·78	49·8	17·80	49·4
25	20·60	56·1	38·59	49·6	19·76	48·3
30	22·55	56·5	40·44	49·5	21·87	47·3
Aug. 4	24·48	57·0	42·32	49·6	24·12	46·4
9	26·40	57·6	44·21	49·7	26·46	45·6
14	28·29	58·4	46·11	50·0	28·90	44·9
19	30·14	29 59·3	48·02	50·5	31·43	44·3
24	31·94	30 0·3	49·91	51·1	34·05	43·8
29	33·69	1·4	51·77	51·7	36·74	43·4
Sep. 3	35·37	2·6	53·60	52·4	39·48	43·1
8	36·98	3·9	55·39	53·3	42·26	42·9
13	38·50	5·3	57·14	54·3	45·06	43·0
18	39·94	6·7	3 25 58·83	55·4	47·88	43·1
23	41·29	8·3	3 26 0·46	56·6	50·69	43·3
28	42·53	9·9	2·01	57·9	53·49	43·6
Oct. 3	43·65	11·6	3·48	14 59·3	56·26	44·0
8	44·65	13·3	4·85	15 0·7	32 58·99	44·6
13	45·53	15·1	6·12	2·2	33 1·66	45·2
18	46·29	17·0	7·30	3·8	4·24	46·0
23	2 25 46·91	86 30 18·8	3 26 8·36	86 15 5·5	5 33 6·74	87 18 46·9

[*Cont.* p. 120.]

Date. 1875.	Radcliffe 2368. R.A.	δ	Radcliffe 2594. R.A.	δ	Groombridge 1850. R.A.	δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
May 31	9 36 30·76	87 10 35·2	10 58 45·37	88 19 21·5	11 58 42·27	86 16 58·7
June 5	29·02	34·4	41·99	21·3	40·75	58·8
10	27·38	33·6	38·65	20·9	39·21	58·9
15	25·85	32·6	35·38	20·4	37·67	58·8
20	24·42	31·5	32·20	19·7	36·13	58·5
25	23·13	30·2	29·13	18·9	34·60	58·1
30	21·99	28·9	26·22	18·0	33·09	57·6
July 5	20·99	27·5	23·46	16·9	31·63	56·9
10	20·13	26·0	20·86	15·8	30·21	56·1
15	19·43	24·5	18·44	14·5	28·85	55·2
20	18·89	22·9	16·23	13·1	27·55	54·1
25	18·51	21·2	14·25	11·6	26·32	53·0
30	18·30	19·4	12·49	10·1	25·16	51·7
Aug. 4	18·26	17·6	10·97	8·4	24·07	50·3
9	18·39	15·8	9·70	6·7	23·06	48·8
14	18·68	14·0	8·68	5·0	22·16	47·2
19	19·14	12·2	7·92	3·2	21·38	45·5
24	19·76	10·4	7·43	19 1·3	20·70	43·8
29	20·54	8·6	7·20	18 59 4	20·11	42·1
Sep. 3	21·49	6·8	7·25	57·5	19·63	40·2
8	22·60	5·1	7·56	55·6	19·28	38·3
13	23·85	3·4	8·13	53·6	19·04	36·4
18	25·26	1·7	8·98	51·7	18·92	34·5
23	26·80	10 0·1	10·10	49·8	18·92	32·5
28	28·48	9 58·5	11·50	47·9	19·05	30·6
Oct. 3	30·28	57·0	13·16	46·0	19·31	28·7
8	32·21	55·6	15·09	44·2	19·69	26·7
13	34·25	54·4	17·27	42·5	20·20	24·8
18	36·40	53·3	19·69	40·8	20·83	23·0
23	9 36 38·64	87 9 52·3	10 58 22·32	88 18 39·2	11 58 21·59	86 16 21·2

[*Cont.* p. 121.]

Date. 1875.	Radcliffe 713. R.A.	δ	Groombridge 642. R.A.	δ	Radcliffe 1474. R.A.	δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
Oct. 28	2 25 47·39	86 30 20·7	3 26 9·30	86 15 7·2	5 33 9·14	87 18 47·8
Nov. 2	47·74	22·5	10·12	9·0	11·41	48·9
7	47·94	24·4	10·80	10·7	13·57	50·1
12	48·01	26·3	11·34	12·5	15·58	51·4
17	47·93	28·2	11·74	14·3	17·43	52·8
22	47·68	30·0	12·00	16·1	19·10	54·3
27	47·27	31·7	12·11	17·9	20·58	55·8
Dec. 2	46·72	33·4	12·06	19·6	21·87	57·3
7	46·02	35·0	11·87	21·3	22·95	58·9
12	45·18	36·5	11·53	22·9	23·81	19 0·5
17	44·20	37·9	11·03	24·6	24·46	2·2
22	43·09	39·2	10·39	26·2	24·88	3·9
27	41·86	40·3	9·61	27·6	25·05	5·5
32	2 25 40·52	86 30 41·?	3 26 8·7c	86 15 29·0	5 33 24·96	87 19 7·1

Date. 1875.	Groombridge 2099. R.A.	δ	Groombridge 2283. R.A.	δ	Radcliffe 3750. R.A.	δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
Jan. 1	14 2 31·08	86 21 0·7	15 18 7·78	87 42 15·9	16 46 23·76	89 16 29·6
6	32·69	20 59·8	9·73	14·5	26·83	27·9
11	34·35	59·1	11·85	13·3	30·70	26·4
16	36·06	58·5	14·12	12·3	35·31	25·0
21	37·79	58·1	16·53	11·5	40·60	23·7
26	39·54	57·9	19·06	10·9	46·53	22·6
31	41·29	57·9	21·66	10·4	46 53·02	21·5
Feb. 5	43·03	58·1	24·32	10·1	47 0·04	20·6
10	44·73	58·4	27·02	9·9	7·49	19·8
15	46·37	58·8	29·73	9·9	15·29	19·2
20	47·94	20 59·4	32·42	10·1	23·36	18·7
25	49·43	21 0·2	35·06	10·3	31·61	18·4
Mar. 2	50·83	1·1	37·63	10·5	39·97	18·2
7	52·12	2·1	40·09	11·0	48·34	18·2
12	14 2 53·28	86 21 3·3	15 18 42·43	87 42 11·8	16 47 56·66	89 16 18·3

[*Cont.* p. 122.]

Date. 1875.	Radcliffe 2368. R.A.			δ			Radcliffe 2594. R.A.			δ			Groombridge 1850. R.A.			δ		
	h	m	s	°	′	″	h	m	s	°	′	″	h	m	s	°	′	″
Oct. 28	9	36	40·96	87	9	51·2	10	58	25·16	88	18	37·8	11	58	22·46	86	16	19·3
Nov. 2			43·35			50·3			28·22			36·4			23·45			17·6
7			45·79			49·5			31·49			35·1			24·56			16·0
12			48·27			48·9			34·93			33·9			25·77			14·4
17			50·77			48·5			38·51			32·8			27·09			12·9
22			53·29			48·2			42·23			31·9			28·50			11·0
27			55·82			47·9			46·07			31·2			30·00			10·4
Dec. 2		36	58·32			47·8			49·99			30·5			31·57			9·4
7		37	0·78			48·0			53·96			30·0			33·21			8·4
12			3·18			48·3		58	57·96			29·6			34·91			7·5
17			5·51			48·7		59	1·97			29·4			36·66			6·8
22			7·74			49·3			5·93			29·5			38·45			6·3
27			9·88			50·0			9·85			29·7			40·24			6·1
32	9	37	11·93	87	9	50·8	10	59	13·73	88	18	30·1	11	58	42·02	86	16	6·1

Date. 1875.	Groombridge 3548. R.A.			δ			Radcliffe 5776. R.A.			δ			Groombridge 4101. R.A.			δ		
	h	m	s	°	′	″	h	m	s	°	′	″	h	m	s	°	′	″
Jan. 1	21	23	49·20	86	31	3·6	22	27	34·81	87	26	57·9	23	27	32·05	86	37	19·3
6			47·85			2·5			32·58			57·2			30·24			19·0
11			46·65		31	1·2			30·49			56·3			28·48			18·6
16			45·59		30	59·9			28·55			55·4			26·79			18·0
21			44·69			58·4			26·78			54·3			25·19			17·2
26			43·95			56·9			25·19			53·0			23·69			16·2
31			43·37			55·4			23·79			51·6			22·31			15·1
Feb. 5			42·96			53·8			22·61			50·1			21·05			13·9
10			42·74			52·2			21·65			48·6			19·93			12·6
15			42·70			50·6			20·92			47·1			18·97			11·3
20			42·83			49·0			20·42			45·5			18·17			9·9
25			43·14			47·4			20·16			44·0			17·53			8·4
Mar. 2			43·61			45·8			20·14			42·4			17·07			6·9
7			44·25			44·3			20·36			40·8			16·78			5·3
12	21	23	45·05	86	30	42·9	22	27	20·80	87	26	39·3	23	27	16·67	86	37	3·8

[*Cont.* p. 123.]

Date. 1875.	Groombridge 2099. R.A.	δ	Groombridge 2283. R.A.	δ	Radcliffe 3750. R.A.	δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
Mar. 17	14 2 54·30	8 26 4·5	15 18 44·64	87 42 12·7	16 48 4·82	89 16 18·5
22	55·19	5·8	46·69	13·7	12·74	18·9
27	55·93	7·2	48·55	14·8	20·31	19·5
Apr. 1	56·52	8·6	50·21	16·0	27·51	20·3
6	56·95	10·1	51·64	17·3	34·26	21·2
11	57·23	11·6	52·84	18·7	40·49	22·2
16	57·35	13·2	53·82	20·1	46·12	23·3
21	57·30	14·7	54·57	21·6	51·13	24·5
26	57·10	16·3	55·05	23·1	55·47	25·8
May 1	56·74	17·7	55·28	24·5	48 59·11	27·2
6	56·24	19·1	55·28	26·0	49 2·03	28·6
11	55·59	20·5	55·01	27·5	4·19	30·1
16	54·80	21 8	54·48	29·0	5·54	31·5
21	53·89	23·1	53·72	30·5	6·12	33·0
26	52·85	24·2	52·73	31·9	5·91	34·5
31	51·70	25·3	51·54	33·3	4·93	36·1
June 5	50·45	26·2	50·12	34·6	3·17	37·6
10	49·09	27·0	48·49	35·8	49 0·65	39·1
15	47·65	27·7	46·67	36·9	48 57·39	40·5
20	46·15	28·3	44·67	37·9	53·40	41·9
25	44·59	28·8	42·50	38·9	48·73	43·3
30	42·97	29·1	40·19	39·7	43·39	44·6
July 5	41·31	29·2	37·74	40·4	37·41	45·8
10	39·62	29·3	35·16	40·9	30·84	46·9
15	37·90	29·3	32·48	41·4	23·72	47·9
20	36·16	29·1	29·71	41·7	16·10	48·9
25	34·43	28·7	26·88	41·9	48 8·01	49·7
30	32·71	28·2	23·99	42·0	47 59·50	50·4
Aug. 4	31·01	27·6	21·04	41·9	50·62	51·0
9	14 2 29·34	86 21 26·8	15 18 18·06	87 42 41·7	16 47 41·41	89 16 51·5

[*Cont.* p. 124.]

Date. 1875.	Groombridge 3548. R.A.			δ			Radcliffe 5776. R.A.			δ			Groombridge 4101. R.A.			δ		
	h	m	s	°	′	″	h	m	s	°	′	″	h	m	s	°	′	″
Mar. 17	21	23	45·99	86	30	41·6	22	27	21·47	87	26	37·8	23	27	16·75	86	37	2·3
22			47·06			40·4			22·38			36·4			17·00		37	0·7
27			48·26			39·3			23·50			35·1			17·41		36	59·2
Apr. 1			49·58			38·3			24·81			33·8			17·99			57·7
6			51·01			37·4			26·29			32·6			18·75			56·4
11			52·52			36·6			27·95			31·6			19·66			55·1
16			54·10			36·1			29·76			30·6			20·71			53·9
21			55·72			35·7			31·70			29·8			21·88			52·8
26			57·38			35·4			33·75			29·1			23·18			51·8
May 1		23	59·07			35·3			35·89			28·5			24·59			50·9
6		24	0·77			35·3			38·10			28·1			26·10			50·1
11			2·48			35·5			40·37			27·8			27·70			49·5
16			4·16			35·8			42·69			27·7			29·37			49·0
21			6·80			36·3			45·03			27·8			31·08			48·7
26			7·40			36·9			47·35			28·0			32·83			48·5
31			8·94			37·7			49·64			28·4			34·62			48·5
June 5			10·40			38·6			51·89			28·9			36·43			48·6
10			11·77			39·6			54·09			29·5			38·24			48·9
15			13·05			40·7			56·21			30·3			40·02			49·3
20			14·24			41·9		27	58·25			31·3			41·76			49·9
25			15·32			43·3		28	0·19			32·3			43·47			50·6
30			16·30			44·8			2·01			33·4			45·14			51·4
July 5			17·15			46·4			3·69			34·7			46·75			52·3
10			17·86			48·0			5·24			36·1			48·30			53·3
15			18·44			49·6			6·64			37·5			49·75			54·5
20			18·87			51·3			7·90			39·1			51·12			55·8
25			19·16			53·1			9·00			40·7			52·40			57·2
30			19·32			54·9			9·93			42·4			53·58		36	58·7
Aug. 4			19·34			56·7			10·68			44·2			54·65		37	0·3
9	21	24	19·23	86	30	58·5	22	28	11·24	87	26	46·1	23	27	55·60	86	37	1·9

[*Cont.* p. 125.]

Date. 1875.	Groombridge 2099. R.A.	δ	Groombridge 2283. R.A.	δ	Radcliffe 3750. R.A.	δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
Oct. 14	14 2 27·69	86 21 26·0	15 18 15·09	87 42 41·4	16 47 31·91	89 16 51·9
19	26·09	25·0	12·12	41·0	22·18	52·2
24	24·55	23·9	9·16	40·4	12·27	52·3
29	23·07	22·7	6·24	39·8	47 2·21	52·4
Sept. 3	21·66	21·4	3·37	39·0	46 52·07	52·3
8	20·32	20·0	18 0·58	38·1	41·91	52·1
13	19·07	18·4	17 57·88	37·0	31·79	51·8
18	17·92	16·7	55·28	35·9	21·73	51·3
23	16·87	15·1	52·77	34·6	11·79	50·8
28	15·92	13·5	50·37	33·3	46 2·05	50
Oct. 3	15·09	11·7	48·12	31·8	45 52·54	49·3
8	14·39	9·9	46·05	30·3	43·31	48·4
13	13·82	7·9	44·15	28·7	34·43	47·3
18	13·36	6·0	42·41	27·0	25·95	46·1
23	13·04	4·0	40·86	25·3	17·90	44·9
28	12·85	2·1	39·52	23·5	10·35	43.6
Nov. 2	12·81	21 0·2	38·39	21·7	45 3·35	42·2
7	12·92	20 58·3	37·49	19·9	44 56·95	40·7
12	13·15	56·3	36·84	18·1	51·20	39·2
17	13·53	54·4	36·42	16 3	46·13	37·6
22	14·07	52·6	36·24	14·4	41·78	35·9
27	14·78	50·9	36·31	12·5	38·19	34·2
Dec. 2	15·64	49·2	36·63	10·8	35·39	32·5
7	16·61	47·6	37·19	9·2	33·39	30·8
12	17·70	46·1	38·00	7·5	32·22	29·0
17	18·89	44 8	39·05	5·8	31·90	27·3
22	20·20	43·5	40·34	4·1	32·43	25·6
27	21·64	42·2	41·87	2·4	33·82	23·8
32	14 2 23·22	86 20 41·0	15 17 43·63	87 42 0·7	16 44 36·06	89 16 22·0

[*Conc'uded.*]

Date. 1875.	Groombridge 3548. R.A.	δ	Radcliffe 5776. R.A.	δ	Groombridge 4101. R.A.	δ
	h m s	° ′ ″	h m s	° ′ ″	h m s	° ′ ″
Oct. 14	21 24 18·97	86 31 0·4	22 28 11·63	87 26 47·9	23 27 56·43	86 37 3·7
19	18·57	2·2	11·83	49·7	57·13	5·5
24	18·03	4·0	11·85	51·6	57·70	7·3
29	17·35	5·8	11·69	53·5	58·15	9·2
Sept. 3	16·54	7·6	11·35	55·4	58·46	11·1
8	15·61	9·3	10·83	57·3	58·64	13·1
13	14·53	11·0	10·12	26 59·2	58·68	15·0
18	13·38	12·6	9·23	27 1·0	58·60	16·9
23	12·09	14·2	8·18	2·8	58·38	18·8
28	10·70	15·6	6·97	4·6	58·01	20·8
Oct. 3	9·22	17·0	5·58	6·3	57·50	22·7
8	7·64	18·3	4·02	8·0	56·86	24·5
13	5·97	19·5	2·31	9·6	56·09	26·4
18	4·22	20·6	28 0·47	11·1	55·19	28·2
23	2·41	21·6	27 58·50	12·5	54·18	29·9
28	24 0·56	22·4	56·41	13·8	53·05	31·5
Nov. 2	23 58·67	23·1	54·21	15·0	51·80	33·0
7	56·74	23·7	51·91	16·0	50·44	34·4
12	54·78	24·1	49·52	16·9	48·99	35·7
17	52·80	24·4	47·06	17·7	47·45	36·9
22	50·82	24·6	44·53	18·4	45·83	38·0
27	48·87	24·6	41·96	18·9	44·13	39·0
Dec. 2	46·95	24·4	39·37	19·2	42·37	39·8
7	45·06	24·1	36·78	19·4	40·56	40·4
12	43·23	23·7	34·21	19·5	38·72	40·9
17	41·48	23·1	31·66	19·4	36·85	41·2
22	39·83	22·4	29·16	19·1	34·98	41·3
27	38·28	21·5	26·72	18·7	33·12	41·4
32	21 23 36·82	86 31 20·5	22 27 24·34	87 27 18·2	23 27 31·29	86 37 41·4

[*Concluded*]

Note on the Probable Disappearance of Two Stars of the 6th Magnitude from the Cluster near B.A.C. 2694.

By John Tebbutt, Esq.

During my observations of Coggia's Comet it has been my custom to determine the positions of the comparison-stars not identified with reference to others which could be satisfactorily identified. The observations on the evening of the 25th August have resulted in a discovery of the fact that two conspicuous stars of the 6th magnitude, namely, B.A.C. 2686 and 2695, are now invisible, at least in my telescope of $4\frac{1}{2}$-inches aperture. I was at first under the impression that the catalogued positions of these two stars were simply errors of observation in north polar distance of the stars 2687 and 2694, the Right Ascension of 2686 differing very slightly from that of 2687, and the Right Ascension of 2695 very slightly from that of 2694. The authorities for the position of 2687 are Taylor, Lacaille, and Brisbane, but the place of 2686 depends on Brisbane alone. It is, however, remarkable that Sir J. Herschel, in his *Catalogue of Nebulæ and Clusters observed at the Cape of Good Hope*, records the positions of two stars of the 6th magnitude which agree within a few seconds of arc with the B.A.C. positions of 2686 and 2687. As, however, the positions given by him were derived from two independent sweeps with the reflector, they may be discordant observations of one and the same star. The authorities for the position of 2695 are Taylor and Brisbane, who, according to the B.A. Catalogue, both observed it in north polar distance, the difference of their determination not amounting to more than six seconds of arc. If they both observed it in Right Ascension also, it can hardly be doubted that the star had an existence. Lacaille is silent respecting this star. Several of the stars in this cluster are of a reddish tint. B.A.C. 2694 is decidedly red.

Windsor, N.S. Wales,
October 22, 1874.

Calculations in regard to the Transit of Venus.

(*Extract from a Letter to the President.*)

By J. R. Hind, Esq.

The observation of time of second internal contact of *Venus* with Sun at Mount Mokattam, published in the last Number of the *Monthly Notices*, quite confirms the inference in my former letter, which was founded upon an observation at Alexandria. Taking a mean of the two sidereal times of contact at Mokattam or $13^h\ 22^m\ 23^s$, with the longitude given on the following page by the Astronomer Royal, I find the local mean time $20^h\ 11^m\ 6^s.9$.

Le Verrier's tables of Sun and Planet, with the semi-diameters for transits recommended in the Introduction to the Tables of *Venus*, give $20^h\ 11^m\ 12^s.3$.

Carlini's Sun and Lindenau's *Venus*, with addition of Airy's long inequality of *Venus* and the Earth, and our old semi-diameters (but $8''.9$ for ⊙'s Hor. Par.) give $12^h\ 57^m\ 33^s.3$.

Hence the error of calculation by Le Verrier's Tables is $= -5^s$: and that by the Tables of Lindenau and Carlini, with Airy's long inequality, $= -13^m\ 34^s$.

Verulam Buildings, Gray's Inn, W.C.
1875, January 8.

Observations of Occultations of Stars by the Moon, and of Phenomena of Jupiter's Satellites, made at the Royal Observatory, Greenwich, in the year 1874.

(*Communicated by the Astronomer Royal.*)

Occultations of Stars by the Moon.

Day of Obs. 1874.	Phenomenon.	Telescope.*	Power.	Moon's Limb.	Mean Solar Time of Observation. h m s	Observer.
Jan. 25	Disapp. of 53 Arietis	Altaz.	100	Dark	11 49 27·96	L
27	,, *k* Tauri	,,	,,	,,	10 41 7·49	E
30	,, *c* Geminorum	,,	,,	,,	6 4 24·39	A D
Mar. 26	,, λ Cancri	,,	,,	,,	11 47 16·13	E
31	,, 10 Virginis	E. Eq.	140	,,	8 27 13·07	C
May 19	,, *c* Geminorum	Altaz.	100	,,	11 30 45·99	C
July 8	Reapp. of 53 Arietis	,,	,,	,,	14 14 48·62	J
17	Disapp. of Piazzi xi. 12	,,	,,	,,	8 52 54·96	C
Oct. 22	,, 27 Piscium	,,	,,	,,	12 7 1·75	L
,,	,, 29 Piscium	,,	,,	,,	13 52 56·05	L
Nov. 19	,, 10 Ceti	,,	,,	,,	10 47 59·22	E
Dec. 19	,, π Arietis	,,	,,	,,	11 15 19·16	J

* The clear aperture of the object-glass of the Great Equatoreal is $12\frac{3}{4}$ inches, of the East Equatoreal 6·7 inches, and of the Altazimuth $3\frac{3}{4}$ inches.

Phenomena of Jupiter's Satellites.

Day of Obs.	Satellite.	Phenomenon.	Telescope.	Power.	Mean Solar Time of Observation. h m s	Mean Solar Time from N. A. h m s	Observer.
1874.							
Jan. 30	IV (*a*)	Ecl. disapp.	G. Eq.	130	12 27 23·0	12 32 10·0	A D
„	III (*b*)	„	„	285	14 39 13·3	14 34 38·9	W C
„	IV (*c*)	Ecl. reapp.	„	„	15 25 53·6	15 24 46·1	W C
„	III (*d*)	„	„	„	17 41 51·3	17 41 1·7	W C
Feb. 10	III (*e*)	Tr. ing. first cont.	„	„	11 23 42·5	11 29	G
„	III	„ last cont.	„	„	11 30 11·5		
„	II (*f*)	„ last cont.	„	„	18 19 6·2	18 18	A D
19	II (*g*)	Ecl. disapp.	E. Eq.	„	13 44 26·5	13 43 28·8	C
Mar. 18	I	Occ. reapp.	„	310	8 28 1 0	8 28	C
23	II	Occ. reap. first cont.	„	140	13 5 20·6	13 9	C
„	I	Occ. disap. first. cont.	„	„	13 29 4·5	13 30	C
„	I	„ last cont.	„	„	13 31 45·3		
24	I (*h*)	Tr. ing. last cont.	„	„	10 42 19·1	10 43	A D
„	I (*i*)	Tr. egr. last cont.	„	„	13 1 7·0	12 58	A D
25	II (*k*)	„ first cont.	„	„	10 12 43·5	10 17	L
„	II	„ bisec.	„	„	10 16 0·1		
„	II	„ last cont.	„	„	10 18 24·5		
„	III	„ „	„	„	10 18 24·5	10 22	L
„	I (*l*)	Ecl. reapp.	„	„	10 21 25·6	10 21 2·5	L
31	I	Tri. ing. first cont.	„	„	12 26 12·3	12 27	C
„	I	„ last cont.	„	„	12 29 41·7		
Apr. 8	I	Occ. disap. first cont.	„	„	11 18 22·7	11 24	G
„	I	„ bisec.	„	„	11 20 52·2		
„	I	last cont.	„	„	11 24 36·6		
„	II	Tr. ing. first cont.	„	„	12 7 14·6	12 8	G
„	II	„ bisec.	„	„	12 9 44·2		
„	II	„ last cont.	„	„	12 12 43·7		
„	III	„ first cont.	„	310	13 49 57·7	13 57	G
„	III	„ bisec.	„	„	13 56 11·7		
„	III	„ last cont.	„	„	14 2 40·6		
„	I	Ecl. reapp.	„	140	14 8 42·6	14 8 53·8	G
16	I (*m*)	Tr. ing. first cont.	„	„	10 19 21·7	10 25	A D
„	I	„ last cont.	„	„	10 24 12·9		
„	I (*n*)	Tr. egr. first cont.	„	„	12 37 53·1	12 41	A D
„	I	„ last cont.	„	„	12 42 15·3		
May 1	I (*o*)	Occ. disap. first cont.	„	„	11 8 56·0	11 9	E
„	I	„ last cont.	„	„	11 10 56·0		

Day of Obs. 1874.	Satellite.	Phenomenon.	Telescope.	Power.	Mean Solar Time of Observation. h m s	Mean Solar Time from N.A. h m s	Observer.
May 1	I (*p*)	Ecl. reapp.	E. Eq.	140	14 20 15·4	14 20 10·8	E
2	I (*q*)	Tr. egr. last cont.	„	310	10 45 12·6	10 43	A D
8	I (*r*)	Occ. disap. first cont.	„	„	12 55 26·4		
„	I	„ bisec.	„	„	12 56 38·2	12 58	G
„	I	„ last cont.	„	„	12 59 0·8		
19	II	Ecl. reapp.	„	„	12 58 7·0	12 58 48·6	C
June 1	III	Ecl. disapp.	„	„	10 13 5·3	10 9 47·3	A D
„	I	Tr. ing. first cont.	„	„	10 18 49·3	10 18	A D
„	I	„ last cont.	„	„	10 21 18·9		
24	I (*s*)	Tr. ing. last cont.	„	„	10 33 4·5	10 32	A D

Notes.

(*a*) The first sensible diminution of brightness was noticed 3^m 30^s before the time recorded above.
(*b*) Definition not good. The first indication of obscuration was noticed 4^m 42^s before the recorded time.
(*c*) The satellite did not attain its full brightness till about ten minutes after the recorded time. It was extremely faint when first noticed.
(*d*) The satellite attained its full brightness about seven minutes after the recorded time. When first noted it was very faint, being overpowered by a patch of scattered light caused by moisture deposited between the lenses of the object-glass.
(*e*) The observation was unsatisfactory, as *Jupiter* was blurred and ill-defined, and the satellite faint.
(*f*) Satellite faint from daylight, the sky being also hazy.
(*g*) The first diminution of brightness was noticed 2^m 36^s before the recorded time. The observation is not a good one, the satellite being very faint, owing to a thick fog.
(*h*) The image of *Jupiter* was diffused, and the observation was, in consequence, not satisfactory.
(*i*) The planet was occasionally obscured by cloud.
(*k*) The image of the planet ill-defined.
(*l*) The sky was not very clear, which may have caused the observation to be a little late.
(*m*) The recorded time is probably rather soon, owing to the diffused light from the planet.
(*n*) Very good definition.
(*o*) The planet was very tremulous.
(*p*) The satellite became suddenly visible, and at first increased rapidly in brightness; it attained its maximum brilliancy about 3^m 41^s after the recorded time.
(*q*) The images were much diffused, the definition being bad.
(*r*) Tremulous.
(*s*) The observation not satisfactory; *Jupiter* very tremulous.

The initials W C, E, C, L, A D, J, and G, are those of Mr. Christie, Mr. Ellis, Mr. Criswick, Mr. Lynn, Mr. Downing, Mr. Jenkins, and Mr. Goldney.

Observations of the Solar Eclipse of 1874, *October* 9, *made at the Royal Observatory, Greenwich.*

(*Communicated by the Astronomer Royal.*)

The circumstances of this Eclipse were very unfavourable for the determination of the corrections to the diameters of the Sun and Moon: in consequence of which, observations were made simply with a view to determining the corrections to the Moon's R.A. and N.P.D., the corrections to the diameters being adopted from the results of the Eclipse of 1870, December 21–22, which were obtained by the same observers as in the present Eclipse.

Taking da = Correction to excess of Moon's R.A. over Sun's R.A.

$d\delta - d\Delta$ = „ „ „ N.P.D. „ „ N.P.D.

$d\mathrm{S}$ = „ Sun's semi-diameter

ds = „ Moon's „

two series of measures were made with the Great Equatoreal, the telescope observations being made by Mr. Christie, and the declination circle microscopes read by Mr. Criswick.

(1) Differences of R.A. of right and left cusps during the half hour following first contact, showing principally the effect of the correction

$$d\delta - d\Delta + d\mathrm{S} + ds.$$

(2) Differences of N.P.D. of the upper and lower cusps during the half hour preceding last contact, showing principally the effect of the correction

$$-da + d\mathrm{S} + ds.$$

Two resulting equations were formed from these by taking the sums of the equations obtained by a comparison of the measured with the tabular quantity as affected by the symbolical corrections, for each of the two series of observations.

The adopted value of $d\mathrm{S}$ being $-1''\cdot68$ and of ds being $-0''\cdot49$,

$$da = -4''\cdot78 = -0^{s}\cdot318$$

$$d\delta - d\Delta = -4''\cdot90.$$

From meridian observations on September 24, 25, 26, 28, and October 8, 10, 20, 28, the correction to the Sun's tabular place was found

in R.A. $= -0^{s}\cdot04$

N.P.D. $= -1''\cdot19.$

Combining this with the result of the equatoreal observations, we obtain for the correction to the Moon's tabular place:

in R.A. $= -0^{s}\cdot36$

N.P.D. $= -6''\cdot09.$

1875, *Jan.* 7.

Observations of the Transit of Venus at Mauritius. By Lord Lindsay.

(*Communicated in a Letter to the Astronomer Royal.*)

I feel sure that you will be glad to hear that my expedition has been in a great measure successful. After a long passage from head winds and bad weather I arrived here on the 1st of November. By the 7th all my instruments were up and approximately adjusted; the weather at first was unfavourable, but latterly it has been fair. Mr. Gill has been able to get eleven entire sets, and four other sets, which combine with the former, of measures of the diurnal parallax of *Juno*, and which I hope, will give good results. For longitude determinations we have 25 or 35 occultations (I forget the number), beside other methods, moon culminations, &c. &c. You will have doubtless heard that my chronometers were sent to Rodrigues by the *Shearwater*, to assist Lieut. Neate in the determination of the difference of longitude between that island and Mauritius (Observatory). I intend to connect my station with Mr. Meldrum's observatory, and so fill up the gap by telegraph; I shall also lay down wires to the German station under Dr. Low.

The morning of the 9th was cloudy before sunrise and for a short time after. The first external and first internal contacts were missed from this cause. We did not see the Sun until $1^h\ 2^m$ after the first external contact, when it came out for a few minutes, when photographs and measures were obtained. It was not till 8 A.M. (local mean time) that it became fairly fine, and remained so, with small periods of cloud obscuration, until the end of the transit.

Photography.—I took 271 plates, out of which number perhaps one hundred (100) will be of value; cloud and the very high temperature of the camera were much against me. Temperature varying from 96° to 116°.

Heliometer.—Mr. Gill obtained five (5) complete determinations of greatest and least distances of the centres of the Sun and *Venus*, besides nine measures of cusps and two separate determinations of the diameter of *Venus* near the end of the transit.

6-*in. Equatoreal.*—Dr. Copeland obtained with this Equatoreal and the Airy double-image micrometer, fifteen (15) measures of least distance of *Venus* from the Sun's limb, and ten (10) measures of cusps. Dr. Copeland also observed the last internal and external contacts with this instrument.

The images of *Venus*, one brought into contact with the other, and then slowly rotated by the position-circle, showed no symptom of oblateness (ellipticity). Dr. Copeland observed the second internal contact with full aperture and first surface reflecting plane. The second external contact was observed with the double-image micrometer; the images superposed on account of faintness of the images.

4-*in. Equatoreal.*—The last internal contact was observed with this instrument and the Merz Polarizing eye-piece by Mr. Gill. He also observed the last external contact with the heliometer.

Both Dr. Copeland and Mr. Gill agree that the contacts of *Venus* and the Sun are remarkably similar to those seen on the Model.

They also agree that any phenomena which could be classed under the head "Black Drop" took place and disappeared within a period of five (5) seconds.

Time.—Transit Instrument.—Very accurate determinations of the time were obtained on the six nights previous; and one star and azimuth-mark, on the night following, by Dr. Copeland with the 4-in. reversing transit.

All the photographic exposures are automatically registered on the chronograph by a method which gives the actual duration of the exposure.

The heliometer observations were also registered thus: Dr. Copeland observed eye and ear—all other observations (photographic and heliometric) were also observed eye and ear as a check on the chronograph.

During the actual work of the transit I had eight assistants, not counting myself or Mr. Davis. Mr. Gill had six, including the Hon. M. Connal, Surveyor General, to whom I am much indebted for valuable assistance. Dr. Copeland had three assistants. All these men formed part of the crew of my yacht—whom I have trained to the work.

I am happy to say that the German Expedition, under Dr. Low, got the third and fourth contacts, and three (3) complete sets of heliometer measures.

Also Mr. Meldrum got the second and third contacts, though rather uncertain as to the first internal contact, owing to cloud. Thinking that, possibly, he would not be able to get time determinations on the night of the 9th, I sent him a box of nine chronometers, which I have left with him for the rating of his clock.

May I ask you to be so good as to communicate this letter to the Royal Astronomical Society, as I have not time to write another account, as the mail goes to-morrow early.

P.S.—One of my photographs shows the second *internal contact* beautifully.

Belmont, Mauritius,
1874, *December* 10.

Observations of the Transit of Venus at Luxor, Egypt.

By Vice-Admiral Ommanney, C.B., F.R.S., and Colonel A. C. Campbell.

Admiral Ommanney, in a letter addressed to E. Dunkin, Esq., Hon. Secretary, dated as under, writes :

"I am glad to tell you that, by a fortunate circumstance, I have had the good fortune to share in observing the transit. At Cairo I became associated with Professor Auwers, of Berlin, and Dr. Döllen of St. Petersburg, who kindly allowed me to share in their expedition. We reached this station a fortnight previously to the transit, where we found Captain Abney and Colonel Campbell already established, with their observatories set up on an island south of Luxor, well situated for the object. As everything connected with the great phenomenon will interest you, I will now briefly inform you of the occurrence as it passed off with us. With regard to the conditions of weather and atmosphere, everything was as favourable for making the observations as could be desired. The Sun rose at 6^h 40^m A.M. local time, with great brilliancy and clearness, so common in Egypt, but on this occasion it was the clearest morning of any we had experienced since our arrival; not a cloud to be seen, and the Nile as smooth as a mirror.

"At the first glance it was a joyous sensation to see the dark orb of *Venus* on the disk of the Sun in her predicted place, making her way rapidly across towards the point of egress, more than three-quarters of her transit having apparently been accomplished. Prof. Auwers had provided me with a telescope and chronometer; in all we were six observers. Captain Abney observed with the photoheliograph, and Colonel A. Campbell with a very fine telescope belonging to Mr. Spottiswoode. Mrs. Campbell was provided with a good telescope, and she acquitted herself most creditably and zealously in the work. Profs. Auwers and Döllen each had a telescope, and previously to the contact the former took measurements of *Venus* with a heliometer. Everyone had gone through the constant practice with models night and day, so we may anticipate that the combined observations from this station will be valuable.

"Each observer was at his station at sunrise, silence was observed, and the intense interest we felt during the brief period of observation you can easily imagine. At first the outline of *Venus* was rather jagged, owing to vibration of the atmosphere, but as the altitude increased this disappeared, and towards internal contact, both the edge of *Venus* and the outline of the Sun's limb, as well as at the moment of contact, the definition was remarkably clear; but although I watched with all possible attention, I could not detect the appearance of a black-drop. Immediately after the internal contact for egress, however, a remarkable phenomenon presented itself: that portion of *Venus*

which had emerged from the Sun's limb became illuminated with a white border, which light continued on the edge of the cusp of *Venus*, with great clearness, until the time when a half of the planet had crossed the Sun's limb; then the light diminished and disappeared about seven minutes before the last external contact.

"The precise moment of last external contact was, to my mind, the more difficult to define. I will now give you the local mean time by my observation, after applying the correction for the error of chronometer.

	h	m	s
Last internal contact at egress	20	16	5·6
Last external contact at egress	20	44	28·1
Difference		28	22·5

"On our comparing notes, the professional astronomers consider that our discrepancies are quite within reasonable bounds. My companions, Prof. Auwers and Dr. Döllen, will make their reports to their own authorities before letting anyone else see them, so I cannot give you their results. They have obtained a great many observations for fixing their position. You will have a very valuable record of the transit from the Sun-pictures obtained at every two minutes interval during the transit, and also from several taken by Janssen's plates."

Luxor, Egypt,
1874, *December* 12.

Colonel Campbell, in a letter addressed to Mr. Browning, dated as under, writes:

"Now that the Transit is over, I can write a few lines. I must say that we were most wonderfully fortunate; the morning was perfection, and everything was in the most perfect order:

"I made contact internal at $8^h\ 16^m\ 10^s{\cdot}6$.
"Hon. Mrs. Campbell $8^h\ 16^m\ 9^s{\cdot}5$.
"Mr. Auwers (from Berlin) $8^h\ 16^m\ 9^s{\cdot}7$.

"The Solar time $2^h\ 10^m\ 45^s$.

"Mrs. Campbell has always been 5^s before me.

"With the model Dr. Döllen was put out by a light which appeared on the leading edge of *Venus* just before contact a silver thread; but I saw at once that it was not the light of the Sun, more like the Moon: we thus regarded it. There was no black-drop proper, only a very faint shadow, and a few interference lines. *Venus* was visible till half her diameter was over the Sun, surrounded by this faint silver light. 14 minutes after contact there was like a bit bitten out of a biscuit, and at $8^h\ 44^m\ 41^s{\cdot}6$ last external contact took place."

Thebes, 1874, *Dec.* 17.

Correction of an Error in the Account of Mr. Thomson's MS. Tables.

By J. W. L. Glaisher, Esq.

I owe to Professor Winnecke, Director of the University Observatory of Strasburg, the correction of an error in the account of Mr. Thomson's MS. Table of Logarithms. On page 462 (*Notices*, vol. xxxiv), referring to a certain table contained in Borda and Delambre's *Tables trigonométriques décimales*, I have said that there was no information to be found regarding it, so that there could be no doubt that it was calculated by Borda himself. Professor Winnecke has kindly called my attention to p. 77 of the *Préface de l'éditeur*, where occurs the following passage, which I had failed to notice: "C'est par ces formules, mais en me bornant aux Δ^3, que j'ai calculé les logarithmes à 11 décimales, depuis 100,000 jusqu'à 102,000. Ces logarithmes étaient annoncés dans la préface de Borda, et même il paraît qu'il les avait fait calculer, puisqu'il les suppose, dans l'exemple qu'il donne, pour trouver à 10 décimales le logarithme d'un nombre quelconque." I may here mention that the blanks in the first column opposite the numbers 89,182, 89,185, on p. 470 are due to the printer; the spaces should be occupied, as is evident from the last column but one, by the figures 7 and 6.

A Preliminary Catalogue of Nebulæ observed at Upsala.

By Dr. Herman Schultz.

For the purpose of forming an exact and somewhat extensive Catalogue of Nebulæ, I have during the last ten years employed a considerable time in making micrometrical measures of the distances between celestial objects of this kind and properly selected comparison-stars, in the carrying out of which the 13-feet Steinheil refractor belonging to the Observatory has been always employed. As, however, great and unanticipated difficulties presented themselves in the prosecution of the original plan for the work, the hitherto obtained results of the observations are far less extensive than I had hoped. A detailed account of this work is newly published in the *Memoirs* of the Royal Society of Upsala.

Definite positions for the Nebulæ cannot be given until after some few years, when I shall have had sufficient time for

revising and controlling my own observations, and, through friendly co-operation of other astronomers, shall have received reliable positions for all the stars of comparison employed. As, however, only a very limited number of exact positions of Nebulæ have up to the present time been published, I think the circumstances make it proper that I should in the meantime publish the following Preliminary Catalogue. Some of the positions will indubitably reappear more or less sensibly modified in the Definitive Catalogue, but the existence of considerable errors in the positions I look upon as quite improbable. A detailed Catalogue of the known positions of the 440 stars of comparison is for publication presented to the Royal Academy of Sciences in Stockholm. For the details of my work I refer besides to the above indicated communication to the Royal Society of Upsala (*Micrometrical Observations of* 500 *Nebulæ*).

The mode of description for the Nebulæ by means of numbers, here employed, was first proposed by Sir John Herschel in the *Results of Astronomical Observations made at the Cape of Good Hope*; and to this work I consequently have to refer my readers for the principles of the descriptive system in question, as well as for the corresponding classification of Nebulæ—in *regular* and *irregular nebulæ* and *irregular clusters*—there proposed by Sir John.

For convenience sake I nevertheless here below insert the descriptive scheme actually employed by me with additional notes from my *Micrometrical Observations of* 500 *Nebulæ*. This scheme for one especial reason ought not to be omitted here, namely, because I have in the details somewhat modified the original Herschelian terminology in the work referred to, with a view to assimilating it as nearly as possible to that adopted by Sir John in his last great work on Nebulæ—the *General Catalogue*. The mode of description proposed in the *Cape Observations* is, however, much more summary than that of the *General Catalogue*, and for facilitating its employment I have even more simplified it, to a system which, as far as my experience enables me to judge, is quite sufficiently precise for the purpose.

Such cursory descriptions as those I here have in view, as a supplement to Catalogues of the co-ordinates of Nebulæ, are evidently quite a different thing from monographical descriptions, in which no perceptible details ought to be omitted. Monographical descriptions cursorily made are worthless; but descriptions which are intended only to be of use as cursory, would lose much in perspicuity by intruding into them monographical details. Should such interesting details accidentally be obtained, they may, in a catalogue of positions of nebulæ, most conveniently be appended in the form of notes.

Sub-Classification of Regular Nebulæ.

(Sir John Herschel's Class I.)

Sub-classes in respect of	Magnitude.	Brightness.	Roundness.	Condensation.	Resolubility.
1	Extremely or very large.	Extremely or very bright.	Nearly circular.	Nuclear.	Resolved.
2	Large or considerably large.	Bright or considerably bright.	Irregularly round.	With a strong central condensation.	Partially resolved.
3	Pretty large.	Pretty bright.	Oval.	With a fainter or a faint central condensation.	Resoluble.
4	Pretty or considerably small, or small.	Pretty or considerably faint, or faint.	Elongated.	Without a central condensation.	Granulate or Spotted.
5	Very or extremely small.	Very or extremely faint.	Much elongated.	Annular.	Milky.
				*	

For the understanding of this scheme, the few following elucidative remarks on its respective columns will probably be sufficient:—

Magnitude (col. 1).

$1 = > 4'$. $\quad 2 = \begin{matrix} < 4' \\ > 2' \end{matrix}$. $\quad 3 = 1'$ to $2'$. $\quad 4 = \begin{matrix} < 1' \\ > \frac{1}{3}' \end{matrix}$. $\quad 5 = < \frac{1}{3}'$.

In the case of "much elongated" nebulæ the magnitude is not indicated.

Brightness (col. 2).

1 = only a few of the brightest nebulæ of *Sir William Herschel's* Class I. and Class VI.

2 = the brighter nebulæ, Class I.

3 = the middle-bright and fainter nebulæ, Class I.; and the brightest Class II.

4 = the faintest nebulæ, Class II.

5 = Class III.

So far as an immediate comparison of the brightness of nebulæ with that of the stars is possible, I assume the nebulæ of the 1st class of brightness to be brighter than a star of the 9th magnitude (Besselian scale); those of the 5th class to be fainter than a star of 12·5 magnitude; and the middle-bright (cl. 3) to correspond in brightness to stars from about the 10·5 to about the 11·5 magnitude. But as those estimations in many cases must become extremely difficult, it is evident that here nothing like a high degree of precision can be expected.

Roundness (col. 3).

3 = length not more than double the breadth.

4 = length not exceeding 5 times the breadth.

5 = length 5 times the breadth or more.

Condensation (col. 4).

In this column of our scheme a * is inserted in the 6th line to remind the reader of the following notation:—

If the nebulæ of the degrees of condensation 2, 3, 4, have a star in the middle, and which in such cases is of course the point observed, I put in the 4th place of their description respectively, *2, *3, *4; and, if nothing is said of the condensation, simply a *.

Resolubility (col. 5).

2 = resolved part of the nebula quite or nearly free from nebulosity.

3 = single stars steadily visible on nebulous ground, or only momentarily seen glimmering through the nebulosity.

Lastly, it is to be remarked that a zero in any of the descriptive places always indicates that no description in that respect could be obtained. After the 5 places of description the magnitude of the nucleus of the central star (*) is indicated according to the Bessel-Argelandrian scale. When the object observed is a star, its magnitude merely is given in the descriptive column.

This may be illustrated by a few examples:—

321 1 3 (10) = nebula, on an average 1′ to 2′ in diameter; of the brighter ones of *W. Herschel's* Class I.; nearly circular; with a nucleus of the 10th mag.; nebulosity with more or less evident traces of resolubility.

242 *2 4 (12) = nebula, on an average 2′ to 4′ in diameter; of the faintest of Class II. (W. H.); irregularly round; strongly condensed; with a central star of 12th mag.; light not equable.

433 * o (11-12) = nebula, on an average ½′ to 1′ in diameter; middle-bright; a little elongated; with a central star, 11-12 mag.; respecting condensation and resolubility, nothing remarked.

The description of a Nebula ought in all cases also to indicate to which of Sir J. Herschel's three classes it belongs; and as, in observations such as the present, objects of the third class do not occur, the simplest course appears to be only to indicate the class when the object belongs to the second class, it being understood that, where no class is mentioned the Nebula is of the first class. In the few here occurring objects of the second class I have thought it best, in so summary descriptions as the present, simply to state the brightness of the stars within them observed.

It is indubitable that it would insure many advantages if the Herschelian mode of description here in question were generally adopted in the Catalogues of Nebulæ.

Catalogue of the Nebulæ.

Nebula.	Mean Right Ascension, 1865·0.	Mean Declination, 1865·0.	Description.
	h m s	o ′ ″	
G.C. 1	0 0 19·33	+26 57 21·6	451 * 5 13
h 1	0 1 49·14	+ 3 51 29·6	452 3 0
h 2	0 1 50·36	+32 40 53·3	541 0 5
h 4	0 2 7·21	+26 58 40·4	431 * 4 11
Nova I	0 2 26·15	+26 58 51·3	542 *4 5 12
* *a* (Nova II)	0 2 35·95	+32 33 30·2	10
h 6	0 3 47·68	+32 36 3·3	443 * 5 13
h 7	0 5 19·49	+30 20 22·4	452 3 0
h 9	0 6 1·64	+30 11 49·6	550 *3 0
h 13	0 8 33·00	+16 34 40·0	431 1 3 11-12
h 16	0 14 10·31	+21 36 28·8	441 1 3 12
h 17	0 14 22·08	+21 41 5·2	442 *2 3 12-13
G.C. 40	0 14 50·94	+21 39 1·8	452 * 5 13
G.C. 41	0 14 51·27	+21 37 8·2	551 * 5 12-13
G.C. 42	0 15 2·56	+21 39 31·9	442 * 5 12
h 21	0 18 55·75	+28 27 50·7	432 1 4 11-12
h 23	0 21 54·77	+ 2 5 31·7	541 *3 3 13
h 25	0 22 19·83	+ 27 5·3	432 1 5 12
h 26	0 23 15·05	+ 1 20 45·9	442 *3 3 13
h 32	0 28 58·14	+23 12 48·8	541 * 4 12-13
G.C. 80	0 29 3·39	+23 13 12·7	551 4 5
G.C. 82	0 29 45·69	+23 14 44·7	441 *3 3 13

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
h 33	0 30 16·87	+ 1 11 52·1	452 *3 5 13
h 39	0 32 18·61	+ 0 7 20·9	443 * 5 11–12
h 40	0 32 22·24	+ 2 17 40·2	432 1 5 12–13
h 37	0 32 22·35	+ 2 35 19·5	542 * 5 12–13
h 41	0 32 23·44	+ 0 10 15·5	542 1 5 11–12
II 857	0 32 27·14	+ 2 3 20·3	442 1 5 12–13
II 858	0 32 38·39	+ 2 8 38·6	542 4 5
h 42	0 32 48·16	+ 2 33 27·8	400 * 0
h 44	0 33 2·37	+40 56 35·1	0
G.C. 5058	0 35 16·10	+ 0 9 51·1	551 * 5
h 51	0 35 20·75	+40 7 28·5	411 1 0 8–9
G.C. 119	0 35 20·93	+ 0 6 18·4	441 1 5
h 50	0 35 22·98	+40 31 40·4	0
h 59	0 40 48·60	+26 53 10·6	442 * 5 13
h 65	0 42 30·39	+31 32 28·1	541 *4 2 12–13
h 78	0 50 13·96	+29 32 59·3	451 * 0 12–13
h 79	0 50 29·76	+29 37 17·2	441 * 0 12
h 84	0 59 50·16	+31 47 52·2	432 3 0
h 85	0 59 52·06	+31 45 37·9	031 0 0
G.C. 205	0 59 58·29	+31 40 56·5	541 1 0 13
h 86	0 59 59·26	+31 41 26·2	031 1 0 11–12
G.C. 207	0 59 59·43	+31 34 15·1	551 4 5
G.C. 208	1 0 1·49	+31 35 51·5	551 4 5
h 87	1 0 56·23	+32 24 43·6	541 1 5 12–13
h 88	1 1 1·00	+38 55 20·2	452 * 3 13–14
G.C. 217	1 1 47·12	+32 1 50·9	453 2 0
h 89	1 1 55·83	+34 59 49·4	432 * 3 11–12
Nova III	1 3 8·06	+32 24 25·7	452 2 5
II 219	1 3 22·67	+32 25 57·7	550 * 5
II 220	1 3 30·34	+32 25 57·7	442 1 4 12
Nova IV	1 3 48·91	+32 23 40·1	452 2 5
h 90	1 4 41·78	+31 24 14·7	441 2 5
G.C. 250	1 8 6·40	+32 21 8·1	442 * 5
I 108	1 12 12·25	+ 2 35 22·2	442 *3 3 12–13
III 250	1 12 46·77	+ 2 41 57·6	343 1 5
III 251	1 13 8·77	+ 2 42 21·2	531 1 5 11
h 102	1 14 21·77	+32 48 48·0	452 * 4 12–13
h 103	1 14 46·87	+ 4 32 55·4	030 1 0 12

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
G.C. 274	1 14 49·49	+ 8 30 0·8	443 2 5
h 104	1 15 21·26	+32 27 59·4	343 3 4
III 156	1 15 21·36	+32 45 49·4	552 * 0 12
II 151	1 15 29·64	+32 43 48·4	050 * 0 13
III 158 = *h* 106	1 15 36·92	+32 45 12·8	432 1 4 11–12
G.C. 293	1 15 51·64	+ 8 20 33·0	441 1 5 12
G.C. 291	1 15 54·25	+32 29 56·2	541 1 5 12
h 108	1 16 5·77	+32 33 2·2	431 1 5 11–12
h 109	1 16 6·22	+32 34 32·0	542 2 5
Nova V	1 16 20·73	+32 47 29·6	543 * 0 12
h 113	1 17 3·12	+32 46 5·3	442 2 5
h 114	1 17 9·19	+32 43 29·6	442 * 5 12
h 117	1 17 42·57	+ 8 50 1·7	432 1 3 11–12
G.C. 308	1 17 47·97	+ 8 59 51·0	552 1 5 13
h 118	1 18 2·61	+34 0 34·3	441 2 2
h 120	1 18 43·72	+34 0 16·2	443 3 4
G.C. 348	1 25 10·50	+29 57 9·5	443 *3 5 13
G.C. 349	1 25 37·20	+29 56 58·2	443 *3 3 12
D'A. Nova	1 25 58·52	+29 59 52·7	442 *3 5
h 131 (* *a*)	1 26 18·14	+29 58 35·9	Class II. 11–12
h 133	1 26 56·78	+30 5 25·0	433 1 3
h 142	1 29 27·53	+15 5 30·4	432 3 4
II 253	1 35 49·85	+12 57 43·5	345 1 5
h 147	1 36 38·11	+28 1 8·1	542 * 0 12
h 149	1 39 48·86	+27 12 32·6	443 1 0
h 150	1 40 16·55	+26 45 26·3	244 1 5
II 228	1 41 58·45	+21 19 27·6	444 3 0
II 229	1 42 20·80	+21 17 53·2	432 1 3 12
h 152	1 42 37·93	+26 58 17·5	444 * 0 12–13
h 169	1 48 52·42	+32 22 54·9	541 * 0 12
h 175	1 49 42·42	+32 32 50·0	443 * 3 13
G.C. 461	1 51 49·33	+18 17 49·3	441 1 5 12
h 181	1 51 55·47	+18 21 0·4	331 1 5 11–12
h 182	1 52 27·34	+30 46 25·5	441 * 4 12
h 194	2 0 36·00	+38 8 1·3	443 3 5
h 193	2 1 8·62	+10 21 9·2	531 * 0 12
h 197	2 1 58·15	+38 33 3·4	450 * 4 12–13
h 208	2 9 50·26	+13 55 2·1	444 3 5

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.	
h 210	2 10 39·33	+13 55 5·0	442 3 4	
h 217	2 14 0·77	+32 38 48·0	443 1 4	12
h 226	2 22 33·07	+36 31 58·2	434 1 5	
h 231	2 26 1·91	+32 21 7·0	442 1 0	12
h 233	2 26 19·63	+32 21 30·3	450 3 0	
h 234	2 26 41·73	+32 15 8·7	441 * 4	12–13
h 242	2 31 57·79	+38 28 46·8	530 1 0	11–12
h 257	2 35 7·55	+31 50 52·7	441 1 3	12
h 260	2 35 41·96	+31 53 56·0	452 * 0	12–13
II 619	2 51 48·74	+24 41 50·2	350 3 5	
h 315	4 21 22·75	+34 58 47·7	042 3 3	
h 316	4 23 43·80	+ 0 21 55·1	442 1 0	12
h 317	4 23 47·44	+ 0 22 5·4	551 * 0	12–13
h 318	4 23 48·09	+ 0 34 5·9	030 1 0	
h 355 (* *a*)	5 22 31·34	+34 8 21·8	Class II	11
h 359	5 29 1·19	+31 54 5·2	442 *3 3	12
h 365	5 34 42·55	+ 9 0 53·6	532 1 3	
h 368 (* *a*)	5 39 48·63	+ 0 1 18·9		
h 368 (* *b*)	5 39 49·92	+ 0 2 7·5	Class II	
h 368 (* *c*)	5 39 50·79	− 0 0 36·5		
h 393	6 25 14·69	+10 15 16·1	020 * 0	
h 399 (* *a*)	6 31 47·50	+ 8 51 8·2	Class II	10
Dunér, Nova	6 37 56·09	+60 59 25·6	442 * 4	12–13
h 406	6 38 24·72	+33 42 8·5	540 * 0	
h 407	6 38 25·43	+33 44 8·9	052 1 5	
h 434	7 0 25·98	+18 59 15·4	351 3 3	
h 444	7 17 2·98	+29 44 59·9	0	
h 445	7 17 5·07	+29 45 16·1	0	
h 447	7 19 40·64	+34 6 24·7	551 0 5	
h 448	7 20 5·58	+34 5 20·5	541 1 5	
h 449	7 20 16·74	+34 7 54·0	441 1 5	13
h 450	7 21 11·23	+21 11 5·7	411 * 0	8–9
G.C. 1537	7 22 55·89	+ 0 3 51·0	552 1 0	
G.C. 1538	7 23 0·89	+ 0 3 43·5	552 1 0	13
h 456	7 28 4·09	+35 32 17·0	541 3 4	
h 457	7 28 59·34	+39 10 47·7	332 3 4	
II 616	7 35 37·56	+32 58 6·1	443 *3 3	12
h 481	7 53 57·29	+16 4 44·3	442 1 4	12

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
h 483	7 55 3·45	+ 9 47 7·2	431 * 0 12
h 482	7 55 5·09	+23 45 54·5	442 2 3
h 489	8 1 35·80	+34 20 56·6	542 *3 4
h 494	8 6 18·99	+21 45 40·2	440 2 0
h 495	8 8 2·29	+58 13 1·6	433 1 3 11
h 497	8 9 52·91	+23 53 13·4	542 1 3 11–12
h 500	8 12 30·50	+21 33 9·7	541 * 0 12–13
h 501	8 12 42·81	+21 29 23·5	541 * 0 12–13
II 259	8 14 56·48	+22 58 51·2	432 1 5 11–12
h 507	8 24 15·67	+23 0 46·9	542 * 4 12
h 526	8 41 39·76	+19 34 16·7	432 1 0 11–12
h 530	8 43 49·67	+51 49 7·9	422 1 5 10–11
h 532	8 44 17·33	+33 55 30·6	224 1 0
h 550	8 56 52·44	+61 0 54·3	354 3 3
h 557	9 0 32·36	+21 59 2·2	442 2 4
h 565	9 3 1·88	+ 9 14 41·7	352 3 4
h 564	9 3 9·49	+ 7 35 6·1	431 * 0 10–11
h 566	9 4 2·53	+35 34 39·2	442 3 3
h 567	9 4 22·95	+35 28 25·8	452 3 3
h 577	9 9 10·68	+20 45 35·2	541 1 5 12
h 578	9 9 27·82	+20 37 51·7	551 * 5 12–13
h 584	9 12 41·20	+51 32 49·9	432 1 0
h 593	9 16 3·32	+35 5 22·5	432 1 0 12
h 597	9 18 24·05	+12 0 44·8	431 * 5 11
h 598	9 18 28·95	+12 0 13·6	442 * 5 12
h 596	9 18 59·09	+63 4 29·2	441 1 4 12
I 56	9 24 30·96	+22 5 35·9	233 1 4 11
I 57	9 24 32·82	+22 6 40·5	233 1 4 13
h 608	9 26 31·29	+10 44 55·1	443 3 3
h 609	9 26 48·15	+10 42 19·8	442 * 4 12–13
h 622	9 34 53·69	+32 27 40·3	333 3 3 11–12
h 624	9 35 11·27	+32 32 35·6	432 * 4 11–12
h 627	9 35 30·70	+32 35 35·4	552 *3 5 12–13
h 630	9 35 44·36	− 3 5 3·8	432 * 0 12
G.C. 1916	9 39 4·43	+22 36 54·0	452 * 0 13
h 634	9 39 13·55	+22 38 10·5	552 * 4 12–13
h 636	9 39 39·40	+22 42 46·1	452 2 3
h 645	9 42 56·01	+34 10 55·8	442 3 2

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ″	Description.
h 650	9 44 17·91	+29 52 3·7	541 * 0 12
h 649	9 44 20·99	+69 41 56·0	322 * 0 10
h 656	9 48 15·41	+ 4 54 23·6	043 1 2 12–13
h 659	9 50 54·59	+11 0 4·7	431 * 0 12–13
h 658	9 52 23·53	+69 22 56·6	030 2 4
h 663	9 54 39·34	+25 21 39·9	443 * 4 11–12
h 668	9 58 30·64	− 7 3 53·8	224 1 0 9–10
h 682	10 6 1·17	+23 24 10·8	452 3 3
h 684	10 6 45·42	+ 4 5 29·2	031 * 0 10–11
h 685	10 7 14·62	+ 4 8 3·4	432 * 0 11–12
G.C. 2054	10 10 11·16	+22 21 44·3	042 * 3 13
h 692	10 10 38·36	+22 30 20·2	334 * 0 11–12
h 693	10 10 57·31	+22 34 3·7	431 * 0 11–12
G.C. 2084 (1)	10 15 10·97	+20 33 39·6	551 * 5 13
G.C. 2084 (2)	10 15 11·52	+20 34 1·6	541 * 5 12
II 28	10 16 3·88	+20 34 44·7	331 * 0 11
II 29	10 16 7·65	+20 32 45·6	331 * 0 11
h 711	10 19 42·91	+29 11 35·0	332 * 0 11
h 713	10 20 19·25	+23 32 2·3	442 * 5 11–12
h 714	10 21 43·47	+30 10 49·7	433 1 4 12
Nova V	10 24 14·37	+29 9 38·3	542 * 4 12–13
h 721	10 25 22·32	+29 12 17·9	332 1 4 11–12
h 724	10 28 27·60	+38 1 21·1	334 1 4
h 728	10 29 34·17	+22 34 50·3	432 * 0 11–12
h 737	10 34 57·52	+14 26 58·9	343 3 3
h 739	10 36 6·55	+25 37 46·4	442 *3 4 12
h 743	10 36 49·83	+12 24 37·4	31 * 5 10–11
h 748	10 39 25·46	+14 27 35·0	331 1 4
h 749	10 39 37·94	+12 31 43·6	020 1 0 9–10
h 754	10 40 32·87	+14 41 47·4	530 * 0 11
h 757	10 40 41·35	+13 17 30·1	421 1 2 9–10
h 758	10 41 8·69	+13 20 25·6	420 1 0 10
h 761	10 41 18·96	+13 14 22·8	0
h 765	10 42 17·64	+33 41 43·9	443 1 4 12
h 766	10 42 22·89	+33 42 12·0	541 * 0 12
h 774	10 43 44·56	+14 7 34·4	400 1 0 10–11
II 493	10 43 49·42	+33 28 55·7	341 1 5
h 773	10 43 51·22	+28 41 23·4	431 1 4 11

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
h 775	10 43 58·60	+28 49 37·6	442 1 4 12–13
II 494 (∗ *a*)	10 44 17·88	+33 36 55·0	444 3 0 12
I 118	10 44 40·06	+33 39 57·9	343 *3 4
h 784	10 44 59·33	+ 4 30 27·5	441 ∗ 0 13
h 805	10 53 1·41	+29 41 55·2	332 *2 3 11–12
h 806	10 53 11·49	+14 37 25·3	030 0 0
h 810	10 55 51·32	+28 41 54·0	433 1 5 11
h 813	10 56 22·51	+29 36 47·0	344 3 4
h 815	10 56 43·25	+28 45 43·4	441 1 3 12–13
h 818	10 58 53·57	+ 0 41 31·4	020 1 0 10–11
h 838	11 6 57·72	+55 45 3·5	241 4 4
h 840	11 7 33·32	+13 33 9·6	333 ∗ 5 12
h 843	11 8 19·46	+18 50 41·3	431 ∗ 0 11–12
h 844	11 9 39·34	+18 45 10·2	441 ∗ 0 12–13
h 845	11 9 47·48	+18 47 15·4	431 1 0 10
h 846	11 9 51·75	+18 53 4·3	431 1 0 11–12
h 847	11 10 30·90	+59 31 22·9	433 1 3 10–11
h 854	11 11 52·73	+13 49 47·6	124 1 3 11
h 856	11 12 57·47	+19 5 40·7	431 1 0 11
h 857	11 13 12·09	+13 43 47·3	233 1 3 11
h 859	11 13 12·93	+14 19 57·1	035 2 5
h 861	11 13 20·24	+ 3 42 12·7	533 1 5 11–12
h 864	11 14 10·07	+ 3 58 29·1	433 1 3 10–11
h 871	11 15 19·08	+38 30 15·5	443 2 4
h 881	11 17 24·88	+39 30 15·4	432 1 0 11–12
h 891	11 19 25·85	+17 36 17·5	432 1 5 12
h 890	11 19 38·50	+67 19 56·9	043 ∗ 0 12
h 892	11 19 53·16	+57 37 9·2	445 3 4
h 893	11 20 7·10	+17 46 17·6	442 *3 4 12–13
h 894	11 20 39·93	+17 57 57·4	342 *3 3 12–13
h 897	11 21 3·65	+26 24 11·1	443 1 5
h 898	11 21 5·39	+17 39 47·1	453 1 5 12–13
h 902	11 23 8·16	+10 1 15·2	433 1 3 11–12
h 933	11 32 46·64	+18 27 31·8	542 0 0
h 938	11 33 10·43	+25 26 40·5	443 1 3 12
h 939	11 33 16·56	+18 28 25·3	442 3 3
h 940	11 33 17·80	+18 30 47·2	552 ∗ 0 13
h 943	11 34 0·09	+12 13 7·9	442 2 3

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
h 944	11 34 4·47	+25 34 10·1	542 *3 4 12
h 945	11 34 9·76	+37 17 40·4	443 2 4
h 946	11 34 36·46	+25 32 53·4	053 1 5 13
h 988	11 42 8·95	+27 46 17·9	433 *2 0
h 1005	11 45 53·39	+37 44 18·3	422 1 0 10–11
h 1017	11 49 24·89	+55 52 34·8	432 2 3
h 1029	11 50 32·70	+56 12 36·2	443 *3 3 12
h 1031	11 50 54·17	+56 12 19·2	432 1 3 10–11
h 1047	11 52 26·38	+51 42 47·9	035 1 4 11
h 1049	11 53 37·30	+20 49 33·7	343 *2 3 12
h 1050	11 54 28·93	+62 38 50·6	334 1 4 11–12
h 1054	11 55 15·45	+62 53 18·6	432 *2 3 12
I 224	11 58 30·18	+51 6 10·5	344 3 0
I 206	11 58 40·21	+51 17 33·4	234 3 0
h 1087	11 59 56·17	+67 54 51·2	442 3 0
h 1088	12 0 11·22	+43 49 0·7	035 1 3 11
h 1091	12 0 55·25	+43 52 43·0	551 0 0
Hind, Nova	12 1 19·10	+65 55 36·8	432 1 0 11–12
h 1106	12 3 13·22	+19 17 38·1	421 1 3 10
h 1115	12 4 17·35	+20 55 36·3	442 *3 3 12
h 1125	12 5 51·53	+11 37 42·5	255 3 0
h 1132	12 6 55·70	+15 39 3·5	035 *2 3 12
h 1140	12 8 16·27	+33 56 52·1	431 1 3 11–12
h 1146 *a*	12 8 51·87	+37 4 43·4	330 *2 5 11–12
h 1147 *β*	12 8 53·45	+37 4 17·9	000 * 0 12–13
h 1147	12 9 1·09	+ 7 9 6·2	442 1 3 12
h 1148	12 9 1·77	+13 54 1·5	224 1 2 10
h 1153	12 9 40·65	+ 8 12 42·5	443 * 0 13
h 1161	12 10 14·15	+ 8 22 28·1	432 1 0 12
h 1159	12 10 16·81	+ 7 56 28·1	033 * 0
h 1162	12 10 19·92	+16 4 28·2	443 3 0
h 1168	12 10 48·27	+30 21 27·2	332 1 3 11–12
h 1171	12 11 19·63	+28 55 32·1	434 1 0 10–11
h 1173	12 11 58·06	+15 10 0·6	332 1 3 11–12
h 1178	12 12 28·73	+ 6 7 31·6	541 * 0 13
h 1177	12 12 28·96	+ 6 50 57·3	443 1 2 13
h 1176	12 12 29·73	+ 6 34 29·2	333 1 2 11
h 1179	12 12 39·06	+15 37 43·5	521 1 0 10–11

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
h 1180	12 12 42·67	+ 6 35 46·6	040 * 3 13
h 1178 *a*	12 12 53·67	+ 6 1 59·2	432 1 5 12
G.C. 2849	12 12 55·89	+ 6 45 53·0	443 * 0 13
h 1178 *b*	12 12 56·13	+ 6 12 46·5	432 1 0 12
h 1183	12 13 2·61	+ 6 5 34·5	332 1 3 11–12
h 1185	12 13 3·20	+30 21 48·0	333 1 3 11
h 1187	12 13 28·26	+ 6 8 8·9	332 1 3 11
h 1196	12 14 22·71	+ 5 20 39·8	443 * 0 12–13
h 1204	12 14 46·25	+30 38 44·8	335 1 3
h 1201	12 14 48·48	+ 6 7 58·6	442 *2 5 12–13
h 1202	12 15 1·53	+ 5 13 21·3	231 1 0 11
G.C. 2892	12 16 12·78	+ 5 59 54·7	432 * 5 11–12
h 1213	12 16 18·55	+ 6 49 17·7	452 * 0 13
h 1215	12 16 28·95	+ 6 47 20·4	452 * 0 13
k 1222	12 16 41·89	+ 6 49 50·4	442 * 4 12
h 1212	12 16 45·44	+17 28 13·9	442 *3 0 12
h 1221	12 17 8·22	+17 26 29·6	334 *2 0 11
h 1232	12 17 35·89	+ 8 3 59·0	431 1 3 10 11
h 1237	12 18 13·22	+13 38 5·3	322 1 3 10
h 1239	12 18 21·90	+15 30 37·7	432 1 4 11
h 1228	12 18 24·74	+ 5 40 23·4	432 1 3 11–12
h 1242	12 18 35·44	+18 56 20·5	323 1 3 10–11
h 1250	12 18 51·33	+13 33 29·1	442 1 3 12
h 1244	12 18 56·09	+13 24 34·7	343 1 0
h 1251	12 19 7·03	+18 57 41·1	443 * 0 12
h 1253	12 19 21·27	+13 41 38·6	321 1 0 10–11
h 1258	12 19 43·56	+31 58 16·3	035 1 0 11–12
h 1267	12 20 23·31	+13 29 2·8	443 * 0 12–13
h 1271	12 20 35·56	+11 5 18·2	432 2 3
h 1268	12 20 37·14	+13 2 3·8	453 0 0
h 1274	12 20 50·36	+13 49 34·1	431 * 0 10–11
h 1272	12 20 50·79	+13 3 53·8	451 * 0 13–14
h 1275	12 20 55·37	+13 45 21·3	433 * 0 12
h 1276	12 21 3·33	+13 2 27·4	432 * 0 12
h 1279	12 21 12·55	+10 33 6·8	433 1 3 10–11
h 1286	12 22 5·61	+ 4 19 4·8	030 1 0 11–12
h 1287	12 22 7·56	+13 59 21·2	443 * 0 12–13
h 1288	12 22 10·35	+14 43 32·1	331 1 4 11–12

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
h 1290	12 22 13·30	+13 55 51·1	433 1 0 11–12
h 1292	12 22 29·79	+ 8 54 14·0	531 1 5 12
Struve, Nova	12 22 39·26	+ 8 44 21·3	552 0 0
II 630	12 22 41·31	+14 47 43·5	453 * 5 13
h 1293	12 22 46·12	+ 8 34 12·2	442 1 4 13
h 1294	12 22 55·20	+ 8 44 49·7	221 1 2 10
II 114	12 22 59·10	+14 10 33·7	332 1 3 11–12
h 1295	12 23 4·11	+14 48 55·1	433 1 4 12
h 1296	12 23 9·03	+13 5 42·3	432 * 0 12–13
II 115	12 23 12·47	+14 22 57·0	332 1 3 11–12
h 1298	12 23 27·37	+13 4 31·6	432 * 2 11
II 116	12 23 28·77	+14 19 22·1	453 1 5 13
h 1301	12 23 59·59	+13 8 16·2	211 1 2 10
h 1305	12 24 8·56	+ 8 49 25·4	441 * 4 12–13
h 1307	12 24 40·26	+26 31 15·2	432 1 3 11–12
h 1312	12 25 10·39	+15 9 57·9	035 1 0 11
h 1313	12 25 16·11	+11 55 18·7	433 1 0 11
h 1322	12 26 20·40	+ 8 35 50·5	542 *3 5
h 1329	12 27 11·59	+ 8 26 40·6	224 1 3 11
h 1331	12 27 16·48	+12 4 1·4	532 1 0 11–12
h 1345	12 28 38·09	+15 14 33·4	333 1 3 11–12
h 1343	12 28 41·34	+12 57 53·3	433 * 5 11
h 1349	12 28 48·97	+13 0 29·2	433 * 5
h 1348	12 28 50·83	+13 18 2·2	422 1 4 10
h 1356	12 29 37·70	+12 11 0·4	433 *2 3 11–12
h 1357	12 29 38·59	+26 43 51·6	135 1 4 12
h 1358	12 29 42·86	+12 0 10·0	343 2 5
h 1359	12 29 44·62	+11 59 0·9	443 2 5
M. 90	12 30 1·00	+13 54 25·7	135 1 5 11
h 1361	12 30 2·22	+ 7 59 25·8	335 1 3 10–11
h 1368	12 30 54·46	+12 33 42·3	322 1 3 10–11
h 1371	12 31 35·70	+ 5 3 40·4	442 *2 0 11–12
h 1378	12 33 6·31	+10 55 7·4	432 1 4 11
h 1383	12 34 23·59	+10 53 50·8	432 1 3 11–12
h 1384	12 34 42·15	+ 8 3 25·9	441 * 4 12
h 1386	12 35 13·57	+12 23 18·8	322 1 2 10
h 1399	12 35 56·49	+ 3 25 43·7	231 1 3 11–12
h 1402	12 35 58·72	+12 10 59·8	534 * 0 11–12

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.		
h 1404	12 36 26·73	+ 2 43 5·4	333	1 3	11
h 1405	12 36 44·15	+12 19 20·8	342	*2 3	12–13
h 1408	12 36 51·63	+12 17 33·7	222	1 2	9–10
h 1409	12 36 57·01	+17 7 54·9	433	1 0	11–12
h 1414	12 37 24·48	+32 54 36·9	234	3 5	
h 1419	12 38 13·49	+ 3 47 40·9	332	1 3	11–12
h 1436	12 42 7·58	− 5 3 50·3	433	1 0	11
h 1441	12 42 54·06	+15 54 4·4	035	1 3	
h 1451	12 43 49·47	+26 14 10·7	432	1 3	10–11
h 1466	12 46 9·10	+11 57 52·8	035	1 0	11
h 1469	12 46 36·38	+ 2 54 5·9	432	1 0	12
h 1462	12 47 3·01	+12 9 1·4	431	1 0	10–11
h 1475	12 48 8·63	+29 40 16·0	433	2 3	
h 1486	12 50 5·70	+22 24 50·5	223	1 3	10
h 1500	12 52 41·83	+28 42 24·5	452	* 0	13
h 1498	12 52 43·19	+14 54 3·1	344	* 0	12
h 1502	12 53 3·94	+28 41 20·2	442	0 0	
h 1507	12 53 36·65	+28 42 22·5	441	1 0	12
h 1522	12 57 19·83	+28 54 46·7	543	* 0	12–13
h 1547	13 4 39·17	+37 46 45·6	334	1 0	11
h 1601	13 19 27·10	+ 2 48 16·2	432	*3 0	11–12
h 1622	13 24 10·89	+47 53 35·5	222	1 4	10–11
h 1623	13 24 17·90	+47 57 50·0	422	* 4	10–11
h 1650	13 30 49·3	+ 9 34 27·7	030	1 0	12
h 1664	13 37 7·46	+36 20 10·2	432	1 3	11–12
h 1684	13 44 44·10	+60 51 41·6	332	1 4	10
h 1701	13 48 11·50	+ 5 59 48·3	453	3 0	
h 1703	13 49 20·35	+ 5 55 1·8	332	*2 3	11
h 1705	13 49 24·96	+ 5 40 44·5	342	3 0	
h 1748	14 0 0·39	+55 32 23·4	030	* 0	
h 1776	14 12 46·29	+37 7 1·9	030	1 0	11–12
h 1778	14 13 17·13	+ 4 36 49·8	453	1 5	
h 1779	14 13 32·87	+ 4 33 18·1	531	1 0	11
h 1782	14 14 7·87	+ 3 51 28·7	443	*3 0	12
h 1783	14 14 15·60	+ 3 53 28·3	422	1 0	10–11
h 1854	14 32 27·83	+ 5 56 52·5	432	1 0	
h 1857	14 33 16·76	+ 0 17 35·9	333	2 3	
h 1863	14 34 1·49	+ 0 15 46·5	543	* 0	12

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.	
h 1874	14 38 5·47	+ 2 31 36·7	135 1 3	12
h 1875	14 39 16·75	+ 0 20 51·1	433 2 3	
h 1894	14 53 10·27	+ 2 25 49·1	443 1 0	12–13
h 1896	14 54 20·74	+ 2 14 16·7	431 1 3	11–12
II 541	14 58 36·82	+ 2 9 39·8	442 1 4	12–13
II 542	14 58 36·87	+ 2 37 33·7	432 1 3	11
III 511	14 59 10·42	+ 2 9 32·2	531 1 5	11
h 1901	14 59 38·73	+ 2 7 46·3	331 1 3	11
h 1902	15 0 16·76	+ 2 3 57·9	442 1 4	12
II 751	15 1 19·52	+20 7 8·8	542 1 5	12–13
II 752	15 1 27·02	+20 6 12·6	453 2 0	
II 647	16 23 2·35	+39 41 5·3	542 1 0	12–13
h 1961	16 24 0·99	+39 51 1·2	443 3 3	
II 753	16 26 26·83	+20 6 55·8	443 1 3	
h 1967	16 31 45·88	+36 28 30·5	452 * 5	13
h 1966	16 31 54·18	+39 18 0·6	052 * 0	13
h 1969	16 38 16·66	+37 5 21·5	443 * 0	12–13
h 1970	16 38 50·21	+24 3 10·5	513 3 3	
IV 50	16 43 11·16	+47 46 7·5	431 1 0	11–12
M. 92	17 12 59·79	+43 17 4·8	112 1 1	
IV 37	17 58 36·76	+66 38 16·9	413 4 3	
II 902	18 1 10·49	+17 35 8·1	452 3 0	
h 2000	18 5 33·05	+ 6 49 29·9	512 * 5	7–8
II 907	18 25 12·78	+39 46 26·3	452 1 4	
h 2023	18 48 34·23	+32 51 43·7	323 5 3	
G. C. 4473	19 4 19·82	+ 0 48 42·8	342 4 2	
h 2037	19 11 52·32	+ 6 17 38·3	332 3 4	
h 2043 **b*	19 25 7·34	+ 8 56 34·6	442 4 5	
h 2043 **a*	19 25 8·26	+ 8 56 44·7		
h 2050	19 41 9·53	+50 11 56·8	421 *4 0	10
h 2062	19 56 35·90	+33 9 10·9	442 4 5	
h 2072	20 10 57·25	+30 9 3·5	040 5 2	
h 2075	20 16 22·00	+19 40 29·9	441 *3 4	13
Nova VII	20 27 1·41	+ 6 55 43·6	530 * 5	11–12
h 2081	20 27 34·83	+ 6 56 42·6	321 3 1	
h 2086 **a*	20 37 30·85	+12 1 39·0	10 11	
h 2097	20 55 11·18	+15 39 33·0	431 *3 2	11
h 2102	20 57 50·84	+29 21 52·5	443 * 3	12–13

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
III 209	21 7 19·79	+13 1 13·0	452 3 3
h 2112	21 12 36·40	+25 52 47·1	542 *3 4 13
h 2120	21 23 26·95	+11 34 39·0	310 1 2
h 2121	21 24 33·37	+ 1 53 56·4	552 3 0
h 2125	21 26 30·41	− 1 25 11·6	213 1 2
h 2132	21 41 57·84	+21 32 5·8	452 3 2
h 2135	21 47 43·08	+ 2 18 23·6	452 3 4
h 2139	21 54 15·23	+17 5 28·3	431 * 0 12
h 2149	22 1 49·98	+30 42 3·1	331 1 2 12
h 2160	22 19 54·03	+15 27 44·6	541 1 4 12–13
h 2168	22 27 18·25	+ 4 52 32·8	532 1 5 11–12
h 2169	22 29 25·64	+19 37 24·3	441 *2 4 12
h 2170	22 29 59·56	+20 55 27·7	453 3 4
Nova VIII	22 30 38·62	+33 40 7·1	542 * 0 13
h 2171	22 30 46·41	+ 9 49 52·9	453 3 5
h 2172	22 30 54·15	+33 42 59·7	020 1 0 10
h 2173	22 30 58·40	+23 5 54·9	234 1 0 11–12
Nova IX	22 31 1·34	+33 44 14·2	552 * 0
h 2174	22 31 9·29	+33 44 50·3	452 0 0
Rosse, C.	22 31 12·55	+33 46 47·6	553 4 5
Rosse, E.	22 31 17·22	+33 40 23·7	542 * 0
h 2175	22 31 20·33	+23 5 11·5	453 4 2
Rosse, D.	22 31 34·15	+33 42 36·4	542 * 0 12–13
h 2183	22 43 10·53	+10 53 41·6	542 *3 4 12–13
h 2184	22 43 18·58	+10 59 3·7	442 *3 5 12–13
h 2189	22 45 29·01	+ 0 22 34·1	443 2 3
h 2199	22 53 22·57	+15 15 25·6	443 1 3 12–13
II 249	22 54 25·67	+15 39 51·1	442 * 0 13
h 2201	22 54 32·72	+29 25 14·4	330 *2 5 11–12
h 2200	22 54 34·87	+ 1 1 44·0	442 *3 0 12–13
h 2202	22 55 10·46	+15 15 23·4	453 1 0 13
D.'A. Nova	22 55 11·91	+15 14 56·2	553 1 0 13–14
h 2203	22 55 19·51	+15 14 22·4	441 1 0 12–13
h 2204	22 56 27·74	+ 8 8 54·3	542 1 5 12
h 2205 * *c*	22 58 8·71	+11 35 22·4	13
h 2205 * *b*	22 58 11·40	+11 35 43·7	334 1 0 12–13
h 2205 * *a*	22 58 11·75	+11 37 0·2	11–12
h 2214	23 6 2·30	+11 56 45·1	441 1 4 12

Nebula.	Mean Right Ascension, 1865·0. h m s	Mean Declination, 1865·0. ° ′ ″	Description.
h 2215	23 7 42·44	+ 3 45 54·0	452 * 5 13
h 2217	23 7 50·90	+22 56 58·6	541 * 0 12
h 2216	23 7 51·56	+ 3 47 57·9	344 3 0
h 2218	23 8 20·89	+18 14 13·6	452 *3 5 13
h 2219	23 8 33·70	+18 13 30·8	443 * 4 12
D.'A. Nova	23 8 34·66	+18 18 20·3	452 3 4
G.C. 4917	23 8 48·41	+ 5 58 20·9	450 0 0
h 2222	23 9 0·59	+12 33 16·4	451 * 5 12–13
Nova X	23 9 1·80	+ 3 45 39·6	542 * 5 12–13
Nova XI	23 9 5·77	+ 3 47 11·1	542 * 0 12–13
h 2224	23 9 6·36	+ 5 57 9·2	431 1 5 11–12
h 2223	23 9 9·76	+12 27 38·8	441 * 0 12
III 238	23 9 58·28	+12 44 47·4	452 2 5
G.C. 4934	23 12 46·61	+ 7 19 31·3	043 1 0 12–13
D.'A. Nova	23 12 54·59	+ 7 50 17·5	542 1 4 11–12
D.'A. Nova	23 13 18·72	+ 7 25 43·8	551 1 0 13
h 2230	23 13 24·39	+ 7 28 5·3	431 *2 4 11–12
h 2231	23 13 40·21	+ 7 39 26·5	542 * 5 12
h 2232	23 13 45·50	+16 29 14·7	442 *3 3 12
h 2233	23 13 52·38	+17 28 42·4	431 *2 4 12–13
G.C. 4943	23 14 37·04	+ 7 28 41·0	453 3 0
h 2241	23 19 25·61	+41 47 36·3	421 5 3
h 2242	23 20 31·29	+11 43 30·1	541 * 3 12
G.C. 4967	23 20 42·66	+11 38 26·7	542 * 5 13
h 2257	23 29 19·94	+ 1 24 29·0	541 1 5 11–12
h 2264	23 37 23·96	+10 1 6·0	431 * 3 11
h 2265	23 37 29·04	+ 9 11 6·7	431 1 3 11–12
h 2274	23 44 12·83	+19 23 59·1	431 * 5 12
G.C. 5021	23 44 31·58	+19 20 45·7	552 * 5 13
h 2275	23 44 33·90	+19 21 38·7	444 1 5 12–13
h 2290	23 52 31·64	+19 59 58·0	441 * 3 12–13
h 2297	23 56 19·90	+15 23 35·1	442 2 3
Nova XII	23 56 29·91	+19 57 9·0	443 * 3 13
h 2300	23 57 3·83	+19 59 52·2	344 *3 4

Account by M. Leverrier of his Planetary Researches.

M. Le Verrier has communicated to the Academy of Sciences at Paris the following general account of his researches on the theories of the eight principal Planets: *Mercury*, *Venus*, the *Earth*, *Mars*, *Jupiter*, *Saturn*, *Uranus*, and *Neptune*. *Comptes Rendus*, t. 79, No. 25 (21 December, 1874) :—

The theory of *Neptune*, which I have the honour to present this day to the Academy, completes the *ensemble* of the fundamental theories of the planetary system, the first piece of which goes back to the 16th September, 1839, five and thirty years ago.

The numerous developments added from year to year are all of them mentioned in the *Comptes Rendus*. Some of them appear by their title only, and as they are dispersed in a large number of volumes, the Academy will, I hope, permit me, now that I arrive at the termination of this long discussion, to present a precise, but brief, *résumé* of them.

In 1849, already engaged for ten years in the work, and being in a position of better appreciating its difficulties, I presented the essential conditions in terms in which I have nothing to change.

None of the Tables, we said, intended to represent the movements of the planets accord rigorously with the observations. The most precise of them, those of *Mercury* and the *Earth*, leave much to be desired. I do not here speak of those irregular deviations which the uncertainty inseparable from all physical measurement introduces of necessity between observation and calculation; but of the systematic errors, the variation of which follows a determinate law, the real existence and regularity of which come out from the entirety of the observations of different observatories, and for which the theory alone is responsible.

These uncertainties deserve to fix our attention: doubtless they are inconsiderable, but, on the other hand, they exist everywhere, and their smallness does not authorise us to neglect them.

It would assuredly signify but little in itself that our astronomical tables made an error of a half-second in the time of a meridian passage, if the importance of this error did not consist in its degree of certainty rather than in its magnitude. Every deviation indicates an unknown cause, and may be the source of a discovery. If these deviations are to increase considerably with the time, we might, it is true, wait for their complete development to read with more certainty in their progressive march the cause which produces them: but first, we should leave to posterity the care of perfecting science, and the advantage of learning new truths: and next, certain foreign actions may manifest themselves by effects which are always little sensible;

and if we should disdain these effects, the cause on which they depend would remain for ever unknown.

The theory of the movement of a planet rests on hypotheses the consequences of which were not on many points deduced with sufficient rigour; and on this account it was impossible to decide whether the disagreements found between observation and calculation depended merely upon analytical errors, or whether they were in part due to the imperfection of our knowledge of celestial physics.

It was therefore necessary to take up the mechanical theories of the movements of the planets, and to scrutinise them in their ultimate consequences, before it was possible to realise a decisive comparison with observations. This is what has been done.

We remark that the general developments have been the object of five Memoirs, presented and published in 1840, 1843, 1849, and 1855.

The formulæ relative to the secular inequalities have been treated in particular in the Memoirs of 1840 and 1841.

The same subject has been resumed in a more general and more complete manner in the work communicated to the Academy under the date 11 November, 1872, on the four great planets: *Jupiter*, *Saturn*, *Uranus*, and *Neptune*.

The theory of *Mercury*, presented in 1843, but afterwards completely remodelled, was definitely completed only in 1859.

The theory of *Venus* was given in 1861.

That of the Sun (the *Earth*) in 1853 and 1858.

That of *Mars* in 1861.

The theory of *Jupiter* in 1872 and 1873.

That of *Saturn* in 1872 and 1873.

The theory of *Uranus*, given in 1846, and connected with the discovery of *Neptune*, has been the object of a new work presented the 15th November last (1874).

Finally, the last theory, that of *Neptune*, is this day offered to the Academy.

The theories of *Jupiter*, *Saturn*, *Uranus*, and *Neptune* have the character that they are developed in functions of indeterminates, in such wise that their employment may be prolonged for an unlimited time.

The theories once established, it was necessary to compare them with the long and precious series of meridian observations imagined by Roemer, instituted for the first time at Greenwich, in the month of September, 1750, by the illustrious observer Bradley, and continued thence up to the present time in the great Observatories. But as the positions of the planets are referred to the fixed stars, it will be understood that it was also necessary to make sure of the fixed stars themselves, relatively to each other, and with respect to the equinox and the ecliptic. This necessity arises particularly in regard to the Right Ascensions, on which chiefly depends the knowledge of the movements of the

planets. The work was effected in the Memoir of the 5th April, 1852, on the totality of the observations of Bradley. This was a delicate subject, for the question was to review Bessel's work, contained in his treatise entitled *Fundamenta Astronomiæ*. We had to propose various corrections to the positions of the fundamental stars, and the verification of the exactness of these corrections was proposed as a Prize question in Germany. The result confirmed all my determinations. Consequently, they have served to establish with security the positions of the comparison-stars during the one hundred and twenty years of observations which had to be considered.

The comparison of the movements of *Mercury* with the theory obtained in 1843 did not at first present a satisfactory result. The transits of *Mercury* afforded data of very great precision, and which could not be completely satisfied.

This first result naturally filled us with inquietude: had we not allowed some error in the theory to escape us? New researches in which everything was taken up by different methods ended only in the conclusion that the theory was correct, but that it did not agree with the observations. Long years passed, and it was only in 1859 that we succeeded in unravelling the cause of the anomalies arrived at. We recognised that they were all included under a simple law, and that it was sufficient to increase the motion of perihelion by thirty-one seconds in the century, to bring everything into order.

The displacement of the perihelion thus acquires in the planetary theories an exceptional importance. It is the surest index, when it has to be increased, of the existence of cosmic matter as yet unknown, and circulating, like the other bodies, round the Sun.

The consequence is very clear. There exists in the neighbourhood of *Mercury*, doubtless between the planet and the Sun, a matter as yet unknown. Does it consist in one or more small planets, or in more minute asteroids, or even in cosmic dust? The theory tells us nothing on this point. On numerous occasions trustworthy observers have declared that they have witnessed the passage of a small planet over the Sun; but nothing has been established on the subject ['on n'est parvenu à rien coordonner à ce sujet'].

We cannot, however, doubt the exactness of the conclusion. We shall, in fact, see the like analysis applied to the discussion of the observations of *Mars* conduct to an analogous consequence, and that this consequence is thus completely verified.

Bessel said of the theory of the Sun that it had not made the progress which might have been expected from the great number and the goodness of the observations. This appreciation long troubled our mind, too confident as we were in this pretended precision of the observations. After having reviewed, discussed anew the observations of the Sun made since the epoch of Bradley at Greenwich, at Paris, at Königsberg, to the number of

9,000, our conclusion was quite different: viz., that the observations of the Sun leave much to be desired, by reason of systematic errors affecting them, and that there exists no discordance between theory and observation which cannot be attributed to the errors of this last.

Nevertheless, the discussion of the observations of the Sun led us at once to an important result connected with the great question which agitates at this moment the scientific world: a result which surprised us ourselves, so great was the false confidence inspired by the determination of the parallax of the Sun deduced by the Director of the Berlin Observatory from the transits of *Venus* in 1761 and 1769. I arrived at the conclusion, that the parallax of the Sun, then estimated at $8''{\cdot}57$, should be increased by the twenty-fifth part of its value.

Soon afterwards the comparison of the theory of *Venus* with the observations led to the same result, the necessity of augmenting by $\frac{1}{25}$ the parallax of the Sun.

Again, the theory of *Mars* led in its turn to an equally precise conclusion. It was established that it was impossible to satisfy the totality of the observations of *Mars* except by increasing the motion of its perihelion by about one-eighth.

This was the reproduction of the same fact as for *Mercury*, and the consequence to be derived was the same; viz. that the planet *Mars* must be subjected to the action of a quantity of matter as yet neglected, and which had to be estimated at about one-eighth of the mass of the *Earth*.

But then two hypotheses were possible, as we explained at the meeting of the 3rd June, 1861: either the hitherto neglected matter resided in the totality of the ring of the small planets, or else it had to be added to the *Earth* itself. In the second case, and as a consequence, the parallax of the Sun had to be increased by about one twenty-fourth part of its received value,—that is to say, we are led to the result already obtained from the theories of the Sun and *Venus*.

. . . . . .

Jupiter and *Saturn* have given rise to a theoretical work, the extent of which has been considerable, on account of the very large mutual perturbations of the two planets. The comparison of the theory of *Jupiter* with the observations has presented, after suitable modifications of the elements, a complete accordance. Thus the tables of *Jupiter* have been adopted by the Direction of the *Nautical Almanac* to serve in that important work. I owe to our colleague, Mr. Hind, superintendent of the *Nautical Almanac*, the satisfaction of having thus seen the adoption by the astronomical world of my Tables of *Mercury*, the Sun, *Venus*, *Mars*, and *Jupiter*, as they have successively appeared.

The Tables of *Saturn* are now constructed, and their comparison with the observations is almost completed.

The theories of *Uranus* and *Neptune* are also terminated, and there remains only to compare them with the observations.